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Introduction

Welcome to this issue of the ***Business Education Innovation Journal***.

The purpose of this journal is to assemble researched and documented ideas that help drive successful learning and motivate business students to learn. The intention is to draw ideas from across both methods and disciplines and to create a refereed body of knowledge on innovation in business education. As a result, the primary audience includes business education faculty, curriculum directors, and practitioners who are dedicated to providing effective and exciting education.

We invite you to read about innovations published and apply in your classroom. We also encourage you to develop your original creative ideas, prepare an article, and submit for review.

This particular issue includes a number of interesting classroom innovations in diverse areas.

Peter J. Billington
Editor

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An Effective Oral Management Briefings Course Design: Taking Students from Scared to Skilled

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ABSTRACT

This article describes one guaranteed approach, as seen from years of experience, to successfully teach an effective oral reporting and management briefings course. Students' satisfaction has been high and student skills are markedly improved using this approach. Details for course design and implementation are given in every aspect of the course: suggested course plan, ideal class size, numbers and types of presentations assigned, time limits on presentations, elimination of verbal fillers, evaluations of presentations, video-taping and feedback sessions, resources used, and issues of absenteeism. Students' course evaluations have historically always been above average using these techniques. Instructors will find ideas they may want to incorporate wholly or in part into their own management briefings or oral business presentation course.

Keywords: oral business presentations, management briefings, course design, stage fright

THE IMPORTANCE OF LEARNING TO ACCOMPLISH EFFECTIVE ORAL MANAGEMENT BRIEFINGS

Oral reporting skills are essential for many successful careers, especially in management. The emphasis on these skills has continually been discussed (Nelton, 1991; Francese, 1994; Lubin, 2007). In a survey of 725 upper and middle managers, presentation skills were listed as the most important skills needed for success in today's business environment ("Critical Link," 1991). Maes, Weldy, and Icenogle (1997) also found managers cited oral communication skills as the top skill needed. In more recent times, the importance still has not changed. Gail Golden, a consultant for RHR International, an executive-coaching firm, states that the skill "is really important for career success, promotions and professional credibility" (Lubin, 2007, D4). Of 34 business-related skills, making effective oral presentations was ranked second by department chairs as the individual skill which they believed was most crucial for graduating business students (Wardrope, 2002). Yet some studies suggest that new graduates of business programs are not equipped with the proper skills to orally communicate effectively (Gray, 2010). Sapp and Zhang (2009) found that in a study of 234 business supervisors over a five year period, "spoken communication skills" was cited as one of four skills of eleven where most skills development is needed by business interns in their organizations.

Developing these presentation skills can be accomplished in one course when the emphasis is placed on practice. After teaching an Oral Reporting and Management Briefings course for over twenty years, the author presents a successful program. In this program, students leave the course with the ability to give concise, effective presentations without undue anxiety.

The evidence to support the claim that the course works is the following: 1) Students' skills improve with each presentation delivered in the course, and their confidence level increases; 2) Students have frequently come back and thanked the instructor for what the course has taught them: to deliver successful presentations while controlling stage fright. (One graduate who had been made the top trainer at Kohl's' corporate headquarters attributed her success to the course because she came into the class with extreme anxiety and learned to conquer her fears of speaking.); 3) Student evaluations of the course are always extremely high with comments such as: "This has been the most useful course I have taken in my program," and "All students should be required to take this course"; and 4) The oral reporting and management briefings class has been frequently cited on the senior survey which asks from which course did you learn the most.

This paper will describe the format of the course and why it could be adapted to fit various curricula. Instructors will find ideas here that they may want to incorporate wholly or in part into their own courses.

COURSE DESCRIPTION, OBJECTIVES, AND SIZE

The course stresses the basic principles of oral reporting with emphasis upon informational speeches and special techniques of management briefings. The purpose of the course is to teach students how to prepare and deliver effective oral presentations. Course objectives state that students will be able to: 1) deliver a concise, interesting and effective presentation, 2) select and use appropriate presentation aids, 3) handle stage fright and anxiety, 4) use effective platform and vocal techniques, and 5) make the best use of the audience question period.

To accomplish the goal of teaching effective presentation skills there must be plenty of practice. Class size should be limited to 15-20. The students are on their feet in front of the audience six times during the semester, delivering four formal presentations and two informal presentations.

TOPICS, POINT TOTALS, AND OTHER SPECIFICATIONS OF FOUR FORMAL CLASS PRESENTATIONS

Regarding topic choice, when the instructor first taught this course, the students made presentations as if they were speaking to executives. For example, the class would pretend to be the top management officials of the local Fisher Price plant, and the presentation would concern persuading the officials to open an on-site daycare center for the employees' children. This proved to be unsuccessful. The presenter had to do significant research to get information on the topic and frequently fabricated the information. The audience, having no experience as business executives, was poorly equipped to evaluate the information presented and poorly prepared for asking appropriate questions during the question/answer session at the end.

Focusing on the true objective of the course, which is to teach skills in preparing and delivering effective oral presentations, it was decided that students could choose their own topics within some constraints. The four formal presentations increase in length and point value as the skills are developed. The instructor can hold the students to high standards since the point level is low early in the course. Because speaking within the time allocated in a program is an indication of a disciplined and courteous speaker, there is also a point penalty for going under or over the time limits (McNeely, 2006c).

Formal Presentation #1: 4 to 6 Minutes: Point Value = 25
The first presentation is a brief introduction of the speaker to the audience. Students can tell anything about themselves, their backgrounds, family, hobbies, etc. One visual aid is required. Because the text has not been covered at this point in the semester, these presentations are graded generously. However, there is a point penalty for violation of the time limit under or over, which is ½ point for each minute.

This presentation assignment is useful for a number of reasons. First, since the second step in preparing a presentation is audience analysis, students listen carefully and learn as much as possible about each class member so that they can use this information to deliver more effective presentations to this audience. Second, the students frequently bring in pictures of their families as their visual aids and pass them around as they speak. It is discussed later that this practice is not recommended because the speaker loses one audience member at a time as the object makes its way around the room.

Formal Presentation #2: 6 to 8 Minutes: Point Value = 50
These presentations begin during week seven of the sixteen week course after the text is covered and the students have been tested over the course material. The standard for grading for these second presentations is the textbook. The topic for this presentation is the same for all class members: "Tips on How to Give an Effective Presentation." The presentation MUST add something new to the class' knowledge base beyond the required text; therefore, some research is necessary. There is so much literature in this area that it is not difficult to find fresh ideas or to present known ideas in a fresh, creative way. Of course, visual aids are required. Topics in the past have ranged from "How to Make the Audience Like You," or "Effective Use of Humor in Presentations," or "Facial Expressions and Nonverbal Communication from the Audience." There is an increase in the penalty to one point per minute for violation of the time limit.

During the class period prior to the delivery of the second, third and fourth formal presentations, the students submit a sheet containing the following: 1) a one sentence objective statement of their presentation, 2) a couple of paragraphs containing the audience analysis, 3) an outline for the presentation, and 4) a list of equipment needs such as an easel, a pointer, colored chalk, computer and projector for power point, etc. Requiring this prep sheet reinforces to the students the necessity of early preparation. Failure to complete this assignment results in five points being deducted from the presentation grade. To ensure that students have thought about the three major parts of their presentations, the following outline is required.

Title

I. Introduction
   - A. Create Interest
   - B. State Purpose
   - C. Preview of Main Ideas
   - D. Credibility Statement

II. Body
   - A. First Main Idea
     Transitional Sentence
   - B. Second Main Idea
     Transitional Sentence
   - C. Third Main Idea
     Transitional Sentence
   - D. Fourth Main Idea if needed
     Transitional Sentence
   - E. Fifth Main Idea if needed

III. Conclusion
   - A. Restatement of Purpose
   - B. Review of Main Ideas
   - C. Call to Action if appropriate or Dynamite Closing Line

Formal Presentation #3: 8 to 10 Minutes: Point Value = 75
At this point in the semester the students have read a text, have been tested over it, and have heard about 15 eight-minute presentations reinforcing the key aspects of preparing and delivering presentations. There is, one might say, no excuse for not knowing what one is supposed to do. Visual aids are required and research is necessary. The time penalty has increased again to 1.5 points per minute violation.

Because this course is taught as a required management course and most students are management majors, the topic for the third presentations is simply "An Issue of Concern for Managers Today" or an issue related to career success. Some examples are "Drug Testing in the Workplace," "How to Conduct a Meeting," or "How to Get Your First Promotion."

Formal Presentation #4: 10 to 12 Minutes: Point Value = 100
The topic for the final presentation is simple: one that will interest the members of their audience. The topics are as varied as "Job Interviewing Skills," "What to Consider BEFORE Having Children," and "Business Lunch Etiquette." Visual aids are required and some research is necessary. This presentation serves as a performance final in addition to the comprehensive written exam. The students should be able to demonstrate that they have absorbed all of the concepts of the course. The time limit penalty is two points per minute.

MIND MAPPING AS A TECHNIQUE FOR GENERATING MAIN IDEAS

The third step in preparing a presentation, after establishing the objective and analyzing the audience, is to develop a blueprint for the presentation. This is essentially the framework of the key ideas that must be presented if the objective is to be accomplished. Mind mapping is taught as an approach to this step (Gelb, l988).

To develop a mind map, presenters draw a symbolic picture of their topic in a circle in the center of a large piece of paper. For example, a picture for a presentation on business lunch etiquette might be a place setting of a lunch plate

with knife, fork, and spoon. Presenters then brainstorm recording ideas about the topic on lines radiating out from the circle. In addition to the words generated, pictures and colors are used to help the ideas flow more readily. The more ideas and pictures, the better. After the brainstorming session is completed, the presenters step back, evaluating closely the ideas recorded, selecting only those three to five main ideas which support the objective of their presentations. When presentations fail, the student and instructor often do a mind map of the topic during the feedback session and quickly discover where the main ideas went astray of the overall objective of the presentation. Mind mapping has proven to be a very effective technique for developing the body of a presentation.

SPECIFICATIONS FOR TWO INFORMAL PRESENTATIONS

Twice during the semester the students are required to read and summarize an article related to some aspect of oral reporting. The students present these summaries to the class in a brief presentation. This gives the students two additional times to be in front of the audience.

A common problem for many presenters is the repeated use of verbal fillers while speaking such as "ah," "um," or "you know." A fun class activity resulting in over a fifty percent decrease in verbal fillers involves audience members gently tossing paper wads at speakers when they use verbal fillers while they are delivering this second article summary. The details of this class exercise are outlined in McNeely (2006b).

AUDIENCE ANALYSIS TECHNIQUE

Because knowing the audience is critical to the success of a presentation, below are the two paragraphs required to be submitted the class period prior to their delivery date.

General Analysis
This audience is made up of ____ (number) individuals. ____ females ____ males Their relationship to me is _____. We have been in this relationship for _____ weeks. Their ages range from about ___ to about ____. Their education level is _____. Their willingness to accept the ideas in my presentation is _____.

Specific Analysis
The audience knows _____ about my topic. (How much?) This audience's attitude toward my topic is _____. This audience's attitude toward me is _____. Their reason for attending my presentation is _____. Does my presentation objective have any advantages for individuals in the audience?
Does my presentation objective have any disadvantages for individuals in the audience?
Because of the nature of my audience, the types of information and techniques that I will use are _____. The types of techniques that might get a negative reaction from my audience are _____ (Morrisey, Sechrest, & Warman, 1997).

CONTROLLING STAGE FRIGHT AND ANXIETY ISSUES

Since the fear of speaking in front of others is one of the worst fears many people experience, a week is spent covering anxiety issues. In the article "The really frightening thing about stage fright: why EVERY oral reporting class needs a lesson on controlling anxiety" (McNeely, 2003), examples are cited of students changing their majors because of the required Oral Reporting class and accepting a zero on assignments if required to speak in class. Also, seniors are frequently encountered who have not taken the required freshman level speech course simply because of nervousness. Since many class presentations are necessary in upper level courses, the students have not had the training provided in the business curriculum.

Anxiety management is a critical topic in the course. One student wanted to take the course but waited until it was offered in a five-week summer class because she thought she could stand the stress for five weeks, but not for sixteen weeks. Some individuals are truly crippled by this fear and it should be addressed. A good resource to use is Nelson's (1985) *Louder and Funnier: A Practical Guide for Overcoming Stage Fright*. The instructor may want to use the term "presentation energy" to imply the positive aspect of these anxious feelings. Comprehensive tips for helping students control stage fright are presented in Appendix B.

ASSESSMENT OF PRESENTATIONS

The presentation evaluation form shown in Appendix A is a good one to use for this course model. At the end of the 2nd, 3rd, and 4th formal presentations, the instructor and each student fill out an evaluation form on the speaker. The students are required to sign the form. Requiring students to sign their names at the bottom also results in the students listening more closely to the presentation and taking the evaluation task more seriously. The names of the students are cut off before these forms are given to the presenter in a personal feedback session with the instructor. The students are asked to write at least one positive comment to the presenter and to mention at least one area that needs improvement.

While the students do give an overall grade for the presentation, they are informed it is not helpful to inflate the scores because it does not help the presenters improve their skills, and the instructor always makes the final decision on the grade. It is helpful to review the students' comments; they sometimes see things unnoticed by the instructor.

Video Taping and Personal Feedback Sessions with the Instructor
All formal presentations are videotaped. The students are required to view their tapes and fill out the same form for a self evaluation of their presentations. They bring their self evaluations to a private 15-minute feedback session with the instructor. Starting with the self appraisal, the student states first what went well in the presentation, and then the student discusses what areas need improvement for their next presentation. The instructor's experience has been that students are generally accurate in their self-appraisal, so this task simply reinforces the text material and provides a place to offer words of encouragement. The student leaves the session with the instructor's evaluation sheet containing their grade and all of their fellow students' evaluation sheets (with the names removed, of course). Pre-presentation conferences are offered to students who are struggling with any aspect of their preparation.

Critique Days
After the 2nd, 3rd, and 4th formal presentations, there is a critique day. At the beginning of this class, each student's name is written on the board in the order of delivered presentations. The students then go to the board and write the title or topic of their presentation and their strategy for opening that presentation to get the attention of the audience. The list is reviewed to aid recollection and then the class votes for the most effective presentation.

The vote is private on a slip of paper and tallied by the teacher. Starting with the presentation that received the most votes, the class discusses why that presentation was effective. This exercise serves to reinforce the key points of effective oral presentations.

Holistic Course Assessment
Table 1 gives an overview of assessment components of the entire course.

Table 1: Assessment Overview of Entire Course Plan

Course Requirement	**Points Possible for Requirement**
Presentations	
First Presentation (4 to 6 minutes)	25 Points
Second Presentation (6 to 8 minutes)	50 Points
Third Presentation (8 to 10 minutes)	75 Points
Fourth Presentation (10 to 12 minutes)	100 Points
Exams	
Exam (Chapters 1 and 2 plus class notes)	50 Points
Second Exam (Chapters 3, 4, and 5 plus class notes)	50 Points
Comprehensive Final Exam	50 Points
Other Practice	
2 Periodical Article Summaries (5 points each)	10 Points
Attendance	40 Points
Total	450 Points

ABSENTEE ISSUES

In order to become an effective speaker, one needs an audience. Students rationalize that if they are not giving a presentation on a particular day, it is not important for them to attend class. So to correct this situation I have experimented with numerous attendance policies and have adopted one that results in almost perfect attendance (McNeely, 2006a).

The first day of class students are given 40 class attendance points and told that they will be deducted if they are absent or tardy. The points are deducted on the following schedule:

Loss of 2 points if the student misses a day of instruction
Loss of 5 points if the student misses a critique day
Loss of 10 points if the student is tardy on a presentation day
Loss of 20 points if the student is absent on a presentation day.

A loss of 40 points will lower a course grade by one letter so most students comply. There are excused absences, of course, for university athletic events, illness, etc.

RESOURCES FOR THE COURSE

Resources include one required text and two optional texts. The required text is *Business and Technical Presentations, 4th edition* (Morrisey, Sechrest, & Warman, 1997), a concise paperback text which provides an efficient and effective procedure to use in preparing presentations. It highlights important points concerning the preparation and use of visual aids, and discusses platform and vocal techniques. Worksheets are also included in the text, which provide timeless tips for creating excellent presentations.

Leeds' *Power Speak (1991)* is used as suggested reading. This paperback book is a great supplement with chapter titles such as, "Preparation: The Source of the Speaker's Power," "Power Language: Turning Everyday Words into Persuasion," "Positive Body Language," and "Professional Secrets of the Question and Answer Session." Also, Thomas (1997) comprehensively addresses stage fright in *Public Speaking Anxiety*.

CONCLUSION

Developing effective presentations skills takes effort on the part of the students and time and dedication on the part of the instructor/coach. When students are convinced that their anxiety can be managed and that their preparation is a matter of following the recommended steps of professional trainers who write textbooks as guides, they begin to believe that it is doable. Given the high level of satisfaction of the students who complete this course, as has been described in this paper, other instructors can use this model or parts of this model to develop confident skilled presenters as well. It is indeed an oral reporting and management briefings course design that is guaranteed to be effective.

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Appendix A

Oral Presentation Evaluation Form for Performing Management Briefings

Presenter's Name_____ Topic_____

		Poor Excellent
	1. Introduction grabbed my attention._____	1 2 3 4 5
	2. Purpose was made clear._____	1 2 3 4 5
Intro	3. Preview was included._____	1 2 3 4 5
	4. Speaker established credibility._____	1 2 3 4 5
	5. Three to five main ideas were used._____	1 2 3 4 5
Body	6. Presentation was interesting._____	1 2 3 4 5
	7. Transitions between ideas were smooth._____	1 2 3 4 5
Close	8. Conclusion referred back to Intro and reviewed main ideas._____	1 2 3 4 5
	9. Visual aids were carefully prepared._____	1 2 3 4 5
Visual	10. Quantity was sufficient._____	1 2 3 4 5
Aids	11. Speaker had rehearsed with visuals._____	1 2 3 4 5
	12. Professional dress and appearance_____	1 2 3 4 5
	13. Speaker presented topic with enthusiasm._____	1 2 3 4 5
Platform	14. Body movements were purposeful._____	1 2 3 4 5
Techniques	15. Distracting mannerism were avoided._____	1 2 3 4 5
	16. Good eye contact with ALL audience members_____	1 2 3 4 5
	17. Gestures were natural, not constrained._____	1 2 3 4 5
	18. Voice was strong and clear (not monotone)._____	1 2 3 4 5
Q&A	19. Professional approach to Q/A session_____	1 2 3 4 5
Audience Analysis	20. Speaker had considered the audience's needs, etc. _____	1 2 3 4 5
	21. Objective of the presentation was accomplished._____	1 2 3 4 5

Overall Rating:_____ Adjustment for Time _____ Final Grade_____

(Note: Assignment sheet turned in on time? -5 points if not)

Comments:_____
_____
_____

Evaluator's Name_____

Appendix B

TIPS FOR OVERCOMING STAGE FRIGHT (Nelson, l984)

Quote to remember: THE GOAL IS NOT TO GET RID OF THE
BUTTERFLIES, BUT TO GET THEM TO FLY IN
FORMATION.

PRACTICE!! PRACTICE!! PRACTICE!! PRACTICE!! PRACTICE!!

You are the exception if you do not experience some degree of anxiety. Public speaking is the **#1** fear of most Americans.

Facts about stage fright:

#1 Stage fright is a normal, **healthy** feeling.
No stage fright = boring, insensitive speaker
#2 Stage fright seems more severe to the speaker than the audience.
#3 Stage fright tends to escalate the more we seek to escape.

Two key elements: **PREPARATION AND EXPERIENCE**

As much as 75% of speech anxiety can be avoided through adequate preparation.
Another powerful hint: Don't be selfish and think of self. Be unselfish and think of your audience and your communication goal.

Three Short-term Methods to Reduce Stage Fright:

1. Aware - Accept - Act
   Become AWARE of your fear.
   ACCEPT **and welcome** your fear. See fear as an ally that can make you a better speaker.
   ACT to reduce fear through thorough preparation.

2. Visualization (Gawain, 1978)
   Mentally rehearse the presentation from the beginning to the end as you would like it to occur (without anxiety).
   WHAT YOU VISUALIZE WILL COME TO PASS!

3. Look at one face at a time and complete a thought.
   Return to a friendly face that is giving you positive feedback.
   LOOK AT THE AUDIENCE!!

Controlling Stage Fright Symptoms:

1. If your mind goes blank---Ask the audience "What was I saying?" or "That example will come to me."
2. Speechlessness---Warm up your voice. Remember no one wants you to fail. Hum to yourself. Look at those friendly faces.
3. Racing pulse, pounding heart---Close your eyes and take a slow, deep breath. Think of a peaceful scene.
4. Speaking too fast---Practice your presentation in a slow, deliberate manner. Write notes to yourself , "SLOW DOWN."
5. Excessive sweating---Use a handkerchief and wipe your brow. Loosen your collar before speaking. Wear a white shirt or blouse. Don't remove your jacket. Drink water.
6. Shortness of Breath---Take a deep breath and stretch your arms out. Make yourself yawn. Use, "Let me take a second and

catch my breath; I'm starting to get ahead of myself." And then pause.

7. Dry mouth---Have a glass of water handy.
8. Shaky muscles---Flex your muscles in the restroom prior to your presentation. Move about. Don't hold up a visual aid.
9. Rocking body movements---Plant your feet and gesture from the waist up.
10. Cracking voice---Stretch your neck, roll your head, clear your throat, drink some water, take a deep breath.
11. Loose change---Use a coin purse. Remove coins from your pockets.
12. Twitches and Mannerisms---Rub the area affected. Watch a videotape of the presentation.
13. Drugs for Stage Fright---If necessary, ask your doctor about Inderal.

Other Useful Tips:

* Mentally escape to a peaceful place while waiting to speak.
* Focus on your purpose: Rehearse only the opening sentence.
* Give yourself positive suggestions, NOT negative ones.
* NEVER, NEVER take yourself too seriously.
* Minimize the focus on yourself at the beginning.
* REMEMBER no one knows the agenda for your presentation except you!

A Plan for Lost Control:

1. Acknowledge you forgot--as in daily conversation.
2. Fill in the gap. Summarize, repeat the last point, give a personal example. This gives you time to think.
3. Shift the attention. Ask for a question.
4. Refer to your notes. (Refer to visual aids)
5. Have a catch-all phrase. "It seems like I'm getting ahead of myself; let me take a second and catch my breath."

PRACTICE!! PRACTICE!! PRACTICE!! PRACTICE!! PRACTICE!!

Three Long-Term Strategies for Overcoming Stage fright (Benson, 1975)

1. Learn to Relax: Breathing Exercises
   Meditation

There are several basic steps required to elicit the Relaxation Response.

STEP 1. Pick a focus word or short phrase that's firmly rooted in your personal belief system. For example, a Christian person might choose the opening words of Psalm 23, "The Lord is my shepherd;" a Jewish person, "Shalom;" a non-religious individual, a neutral word like "one" or "peace."
STEP 2. Sit quietly in a comfortable position.
STEP 3. Close your eyes.
STEP 4. Relax your muscles.
STEP 5. Breathe slowly and naturally, and as you do, repeat your focus word or phrase as you exhale.
STEP 6. Assume a passive attitude. Don't worry about how well you're doing. When other thoughts come to mind, simply say to yourself, "Oh, well," and gently return to the repetition.
STEP 7. Continue for ten to twenty minutes.
STEP 8. Practice the technique once or twice daily.

2. Exercise your body regularly so you feel good about yourself.
3. Eat a balanced diet.

PRACTICE!! PRACTICE!! PRACTICE!! PRACTICE!! PRACTICE!!

Readability of Cost Accounting Textbooks

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ABSTRACT

Selection of a textbook for a cost accounting course can be challenging. Many criteria may be considered in such decisions, including a textbook's readability level. However, no study of the readability of cost accounting textbooks has been published in the last thirty years. Using a widely-used readability index, this study analyzes the predicted readability of seven cost accounting texts. T-tests are performed to determine whether significant differences exist between the textbooks. The study finds that one text is more readable than most of the others. Another text is less readable than most others. These findings can be useful to adopters and editors of cost accounting textbooks.

Keywords: readability, cost accounting, textbook, Flesch, Flesch-Kincaid

INTRODUCTION

The selection of a textbook for use in cost accounting courses is an important decision for faculty. Since cost accounting is generally a required course in the typical accounting curriculum, all accounting majors are affected by their decision. But the text selection process is complicated by the large number of text attributes for faculty to consider. Such attributes may include: a text's pedagogical approach; coverage of material; exhibits, charts, and vignettes; end-of-chapter material; student and instructor supplements; and authors' reputations, as well as instructors' past experiences with the text. Faculty may also wish to consider a text's *readability*.

Readability may be defined as the degree to which a class of people finds certain reading matter compelling and comprehensible (McLaughlin, 1969). "Readability" should not be confused with "legibility," which refers to the ease of being read. Readability, in this context, refers to the qualities of writing which are related to reader comprehension. A variety of techniques have been used to predict readability, including several readability indexes (or formulas) which have been used widely since the 1950s. Examples of readability indexes include SMOG (developed by McLaughlin), Flesch Reading Ease, Flesch-Kincaid Grade Level, Gunning-Fog, and Fry.

Information on readability can be helpful to faculty when making textbook adoption decisions. Indeed, one of the criteria to which faculty attach the most significance in those decisions is textbook comprehensibility (Smith & DeRidder, 1997), which can be predicted, at least in part, using a readability index. Evidence also suggests that the higher the readability (difficulty) level of textbooks in core business courses, the lower the grade averages in those courses (Spinks & Wells, 1993).

LITERATURE REVIEW

Ten studies of the readability of accounting texts have been published over the last 30 years. Four of the studies, Traugh et al. (1987), Sullivan and Benke (1997), Chiang et al. (2008), and Plucinski et al. (2009), concerned introductory accounting texts only. Five studies, Razek et al. (1982), Adelberg and Razek (1984), Flory et al. (1992), Davidson (2005), and Plucinski (2009), concerned (at least in part) intermediate accounting texts. One study, Smith et al. (1981), concerned introductory, intermediate, and advanced accounting texts. However, no study published in the last 30 years concerns the readability of *cost* accounting textbooks.

METHODS

One of the ten accounting textbook readability studies completed in the last 30 years (Adelberg & Razek, 1984) used the Cloze Procedure. That procedure gauges readability by deleting every fifth word from passages, then measuring the reader's ability to restore the passages to their original form. The remaining nine studies used readability indexes, specifically the Fog Index, Flesch-Kincaid Grade Level, Flesch Reading Ease, or the SMOG procedure. These indexes use a formula based upon characteristics of text passages, such as average word length, average sentence length, and word complexity, to generate a readability score.

Choice of Readability Index
This study uses the Flesch-Kincaid Grade Level for two reasons. Eight of the ten past studies used one of the Flesch measures. In addition, since the Flesch-Kincaid index can be easily generated using word processing software, a large amount of text can be readily analyzed with results that are objective and easily replicated.

Flesch-Kincaid Grade Level
The Flesch-Kincaid Grade Level has its roots in the Flesch Reading Ease formula developed in 1948 by Rudolf Flesch. In 1975, J. Peter Kincaid tested over 500 enlisted United States (U.S.) Navy personnel on a reading-comprehension test and also on passages from Navy training manuals. This enabled him to derive a version of the Flesch Reading Ease formula which yielded reading grade-level scores. The resulting Flesch-Kincaid Grade Level has since been adopted by the U.S. military services as the basis for deciding whether technical manuals from suppliers meet their readability requirements (Pearson, 2002). The Flesch-Kincaid index is now one of the leading readability indexes. It is used extensively by the U.S. government and others, and it is included as a grammar-checking feature in the word processing software, Microsoft Word (MS-Word).

The Flesch-Kincaid Grade Level formula is based upon sentence length and word length. It rates text on a U.S. school grade level. For example, a score of 11.0 means that an eleventh grader can understand the document. The formula is:
(0.39 x ASL) + (11.8 x ASW) – 15.59
where:
ASL = average sentence length (the number of words divided by the number of sentences)
ASW = average number of syllables per word (the number of syllables divided by the number of words)
(Pearson, 2002)

This study uses MS-Word to calculate the Flesch-Kincaid Grade Level of select passages. The formula used by MS-Word is confirmed by agreeing the formula above to that specified in the MS-Word help file. The MS-Word calculation is then validated by manually applying the formula above to a 200-word passage and agreeing the result to that provided by the grammar-checking function in MS-Word.

Selection and Adaptation of Text Passages
An exhaustive search of cost accounting textbooks currently being published in English by major publishers yields eight such books. One of the texts, authored by Vanderbeck and published by South-Western (Cengage), appears to be abridged, compared to the seven other texts. It has only 504 pages and ten chapters, compared to an average of 851 pages and twenty chapters for the others. In addition, the topics in the Vanderbeck text are arranged in a manner that makes comparison to the other texts impractical. Therefore, the Vanderbeck text was omitted from this study. The remaining seven texts are listed in Table 1 below, along with each textbook's particulars. Six chapters are selected for analysis from throughout those texts.

The chapters (topics) targeted are those covering: cost-volume-profit analysis, job costing, process costing, master budget, standard costs/variances, and capital budgeting. This approach provides passages for analysis from throughout the texts, covering about 30 percent of each text, based upon an average of 20 chapters per text. For all but the Horngren text, digital (computer) files of each of the six target chapters of each textbook are obtained from their publishers. The publisher of the Horngren text, Pearson (Prentice Hall), declined to provide digital content for more than three chapters. Therefore, the digital content for Horngren chapters 4, 6, and 7 is obtained from the publisher; the digital content for chapters 3, 17, and 21 is obtained by manually scanning the relevant pages in the textbook with optical character recognition (OCR) software. All files are then converted or imported into MS-Word for analysis.

Only the sentences in the body of the chapters are subjected to analysis. Appendices are excluded. Since the Flesch-Kincaid formula analyzes only sentences, all material in figures, exhibits, and headings is omitted from analysis. Since material in graphics and vignettes cannot be readily converted to plain text by word-processing software, it is also omitted. End-of-chapter material (e.g., vocabulary, review, problems) is omitted as well, since it is largely quantitative/ tabular in appearance and does not match the textual nature of the Flesch-Kincaid index.

When a colon appears at the end of a sentence, it is replaced with a period when the sentence is originally followed by a calculation, list, figure, or journal entry. This is necessary because, in the Flesch-Kincaid calculation, MS-Word does not recognize a colon as the end of a sentence. Since calculations, lists, figures, and journal entries are removed from the text, a sentence with a colon preceding an entry, for example, would have been combined with the one following the entry, thereby inflating the length of the sentence. In that case, replacing the colon with a period "ends" the sentence before the entry. Colons appearing in sentences that eventually ended in a period are unchanged.

Table 1: Attributes of Cost Accounting Textbooks and Chapters Analyzed

Authors	Blocher/ Stout/ Cokins	Eldenburg/ Wolcott	Hansen/ Mowen/ Guan	Hilton/ Maher/ Selto	Horngren/ Foster/ Datar/Rajan/ Ittner	Kinney/ Raiborn	Lanen/ Anderson/ Maher
Title	Cost Manage-ment	Cost Manage-ment	Cost Manage-ment	Cost Manage-ment	Cost Accounting	Cost Account-ing	Fundamen-tals of Cost Accounting
Subtitle	A Strategic Emphasis	Measuring, Monitoring, and Motivating Performance	Accounting and Control	Strategies for Business Decisions	A Managerial Emphasis	Founda-tions and Evolu-tions	
Edition	5	1	6	4	13	7	2
Year	2010	2005	2009	2008	2009	2009	2008
Publisher	McGraw-Hill	Wiley	Cengage	McGraw-Hill	Pearson	Cengage	McGraw-Hill
ISBN	978-0-073-52694-2	978-0-471-20549-4	978-0-324-55967-5	978-0-073-52680-5	978-0-136-12663-8	978-0-324-56055-8	978-0-073-52672-0
Chapters Analyzed (Number):							
Cost-Volume-Profit Analysis	9	3	17	12	3	9	3
Job Costing	4	5	5	3	4	5	7
Process Costing	6	6	6	8	17	6	8
Master Budget	10	10	8	15	6	8	13
Standard Costing/ Variances	14	11	9	16	7	7	16
Capital Budgeting	12	12	20	14	21	15	App.

After converting, importing and pruning all files, the spelling and grammar function in MS-Word is applied to all files to correct occasional errors that arise and then to obtain the Flesch-Kincaid Grade Level. The text matter in the target chapters is not just sampled; the entire text matter of each of the six target chapters of each textbook is subjected to the Flesch-Kincaid calculation.

RESULTS

Comparison of Textbooks by Chapter

Table 2 below shows the Flesch-Kincaid Grade Levels for the six target chapters of each textbook. The mean of the six grade levels for each text is also shown. Since the grade level indicates the U.S. school grade level required to understand a text passage, the lower the grade level the more readable the chapter.

Table 2: Computed Flesch-Kincaid Grade Levels of Textbook Chapters

	Textbook (Author, et al)						
Chapter Content	Blocher	Eldenburg	Hansen	Hilton	Horngren	Kinney	Lanen
Cost-Volume-Profit Analysis	13.1	13.2	12.3	13.6	12.5	12.7	11.8
Job Costing	13.5	12.1	11.8	13.5	15.0	12.9	12.9
Process Costing	15.5	12.7	13.1	11.8	15.1	13.1	12.8
Master Budget	14.2	13.4	11.8	13.4	13.9	14.2	13.4
Standard Costing/Variances	14.8	13.3	12.3	13.4	14.6	14.1	14.6
Capital Budgeting	14.4	12.5	12.3	13.9	12.9	13.2	11.3
Mean Grade Level (MGL)	14.3	12.9	12.3	13.3	14.0	13.4	12.8

An examination of Table 2 shows clear observations at the extremes. The Blocher text, with the highest *mean* grade level at 14.3, has the highest grade level of all seven texts for four of the chapters. It has the second & third highest grade level for the remaining two chapters. At the other extreme, the Hansen text, with the lowest *mean* grade level at 12.3, has the lowest grade level of all seven texts for three chapters, and the second lowest grade level for two of the three remaining chapters.

These results certainly cast the Blocher text in unfavorable light and the Hansen text in favorable light. However, the Hansen text is not the only one favored in terms of readability. An instructor might actually favor the Lanen text, if he/she is most concerned with the readability of the chapters covering cost-volume-profit analysis, master budget, and capital budgeting; the Lanen text was the most readable for two of those chapters and second most readable for the third.

Overall Comparison of Textbooks

While some texts are more readable than others for select chapters, no one text is more readable (nor less readable) than the other texts for all six chapters. In addition many of the texts' grade levels for each chapter are very close to (or tied with) each other. Clearly, statistical tests are required to determine if significant differences exist between the texts overall (i.e., mean grade levels, or "MGL").

While the entire text of each target chapter is analyzed, those results constitute sample passages relative to the text overall. Therefore, t-tests are performed to determine whether significant differences exist between the textbooks overall. Independent-samples t-tests are performed on the sample means, without assuming equality of variances. Table 3 below shows the p-values of differences between the MGLs of each textbook.

Table 3: T-Tests: P-Values of Differences Between Textbook Mean Grade Levels (MGLs)

Textbook Author, et al. (MGL)	Blocher (14.3)	Eldenburg (12.9)	Hansen (12.3)	Hilton (13.3)	Horngren (14.0)	Kinney (13.4)	Lanen (12.8)
Blocher (14.3)							
Eldenburg (12.9)	.010***						
Hansen (12.3)	.001***	.063*					
Hilton (13.3)	.062*	.307	.023**				
Horngren (14.0)	.672	.056*	.010***	.209			
Kinney (13.4)	.074*	.165	.007***	.807	.256		
Lanen (12.8)	.037**	.902	.338	.432	.097*	.329	
	Blocher (14.3)	Eldenburg (12.9)	Hansen (12.3)	Hilton (13.3)	Horngren (14.0)	Kinney (13.4)	Lanen (12.8)
	Textbook Author, et al. (MGL)						

Notes:

*** Statistically significant difference at the .01 level;

** Statistically significant difference at the .05 level;

* Statistically significant difference at the .10 level.

The Blocher text has the highest MGL at 14.3, which is significantly different (at the .10 level or lower) from five of the six other texts. Particularly significant is the differences in MGLs between the Blocher text and the Eldenburg and Hansen texts; both are significantly different from the Blocher text at the .01 level, with MGLs of 12.9 and 12.3 respectively. No significant difference in MGLs exists between the Blocher text and the Horngren text, which has the second highest MGL, 14.0.

At the other end of the spectrum is the Hansen text, with an MGL of 12.3. Its MGL is significantly different (at the .10 level or lower) from five of the six other texts. In particular, the Hansen MGL is significantly different at the .01 level from the Blocher, Horngren, and Kinney MGLs of 14.3, 14.0, and 13.4, respectively.

The remaining five texts (Eldenburg, Hilton, Horngren, Kinney, and Lanen) occupy a middle ground. When compared to all of the other texts except Blocher and Hansen, two of the remaining five texts had a significant difference from only one other text (at only the .10 level). Another two of the remaining five texts has no significant differences (at .10 or lower) from the other texts (again, ignoring the Blocher and Hansen texts at the extremes). The last of the remaining texts has significant differences from only two texts (ignoring Blocher and Hansen), at only the .10 level.

The results clearly indicate that the Hansen text (with the lowest MGL of 12.3) is the most readable of the seven cost accounting textbooks considered. Conversely, the Blocher text (with the highest MGL of 14.3) is the least readable. However, there are many examples of comparable texts. For example, if the instructor is choosing between Horngren and Blocher, between Lanen and Eldenburg, or between Kinney and Hilton, the decision should not be based on readability; there are no significant differences between the texts in each pairing.

CONCLUSIONS AND LIMITATIONS

Conclusions

If an instructor places substantial emphasis on readability in selecting a cost accounting textbook, he/she should strongly consider the Hansen text. Its predicted readability is significantly greater than most of the other texts. The Blocher text, however, should be discounted, unless readability is not a major consideration in the textbook adoption decision. In terms of readability, there is no compelling evidence to choose any one of the remaining texts, Eldenburg, Hilton, Horngren, Kinney, and Lanen, over any other of those same texts.

Editors of cost accounting texts can also use these findings. There is more to comprehensibility of a subject than the readability of text matter. The diagrams, charts, demonstrations, calculations, and figures included in textbooks are intended to aid in the student's comprehension of the subject matter. Nonetheless, long, complicated sentences, while sometimes necessary, may hinder a student's comprehension when used extensively. Textbook editors may use these findings to set their expectations of authors of future cost accounting textbooks.

Limitations

One limitation in this study concerns readability formulas in general. They assume that the lower the readability level the better; but an unrealistically low readability level may lead to lower transferability of the content. In addition, readability formulas *predict* readability; they do not *measure* it. More costly and time-consuming techniques such as the Cloze Procedure are necessary to actually measure readability. While there have been many critics that questioned the validity and value of readability formulas, there is ample research to suggest that formulas, despite their faults, can predict whether one piece of text will be easier to read than another (Pearson, 2002).

A second limitation is that the results of this study should not be the sole basis for judging the appropriateness of a particular cost accounting textbook. Only the main body of each target chapter was analyzed in this study. The calculations, vignettes, journal entries, charts, exhibits, graphics, figures, and end-of-chapter material are excluded from analysis. Ancillaries such as instructor and student supplements are also not considered. It is likely that an instructor will subjectively evaluate the effectiveness of this material separately from the main body of the textbook.

Finally, as Smith and DeRidder (1997) indicated, business faculty, when making a textbook selection, attach the most significance to comprehensibility to students, timeliness of text material, compatibility between text material and homework problems, and exposition quality of text, respectively. The first of those criteria, comprehensibility, is addressed (at least in part) by this study. Future studies might address comparisons of texts based upon the remaining criteria.

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Constructing Data Sets for Teaching Multiple Regression to Non-Statistics Majors

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ABSTRACT

For teaching multiple regression to non-statistics majors one wants to concentrate on the interpretation of the models. We suggest that regression models be introduced with constructed data sets where a regression equation looks like: $Y = 4 + 5X_1 – 2X_2 - 3X_1X_2$ instead of real data where the equation would look like: $Y = 4.12542 + 5.34523X_1 – 1.99764X_2 – 2.88912X_1X_2$. In the second equation, non-majors' attention is immediately focused on the large number of decimal places and not on the curvature. We believe even professional statisticians prefer the first equation to the second. The paper constructs integer data sets where the model coefficients have integer values.

Key Words: Multiple Regression, Orthogonal, Basis Vectors.

INTRODUCTION

When teaching regression to non-statistics majors at the undergraduate level students may get caught up in the regression calculations and may not pay enough attention to interpreting the results that the calculations produce. Part of the problem is that the resulting regression equation in an example would likely look something like: $\hat{Y} = 1.28762 + 14.68943X_1 – 3.23476X_2$, and a non-mathematical student's attention would naturally be drawn to the size of the many decimal place regression coefficients and not to their values. The student's thoughts would likely drift toward "Where do those numbers come from?" and "Do I have to do that?" The authors believe that at the start of the teaching of regression it is better to use constructed data sets(as opposed to real data sets) where the regression equation might look something like: $\hat{Y} = 1 + 15X_1 – 3X_2$ and which appears to be easy to produce. Such an equation is easier for the students to interpret and as the instructor wants it is easier to notice that the coefficient in front of X_2 has a negative sign. It is also easier for the students to think about whether the number 15 is sufficiently far from zero, making X_1 a significant predictor of Y. The paper details how to construct integer data sets where the regression equation has specified integer coefficients. It is shown that it is ultimately not very difficult to do the construction.

A common textbook regression example is predicting housing prices from a number of possible regressors, two of which would be the size of the house and the number of bathrooms in the house, for example: Moore, McCabe, Duckwoth, and Alwan (2009); Levine, Stephan, Krehbiel, and Berenson (2008). Both of these predictor variables would be expected to be positively related to housing prices, perhaps with size being more important than the number of bathrooms. It is possible to define hypothetical integer data sets where this is the case(the t-statistic is higher for the size variable) and where either of the variables, or both, or neither can be chosen to be statistically significant. The two variables, size and number of bathrooms, could be expected to be correlated. If they are highly correlated the data set might exhibit multicollinearity. The paper shows it is possible to construct integer data sets with integer regression coefficients that exhibit the signs of multicollinearity. To a surprising extent the data sets can also be chosen to have integer averages, integer sample standard deviations, and have correlations that are relatively simple rational numbers.

We indicate the technique for constructing the data sets with a simple example. Suppose that the first predictor variable takes on the values 1, 2, 3, and 4, which can be represented as a vector $\mathbf{X_1} = [1\ 2\ 3\ 4]^T$ (^{T} denotes transpose) and suppose we just take a second predictor variable to be $\mathbf{X_2} = [4\ 1\ 2\ 3]^T$. Suppose further that we wish the regression equation to be $\hat{Y} = 1 + 15X_1 – 3X_2$. If we simply choose the vector $\mathbf{Y}$ to satisfy the equation $\mathbf{Y} = 1 + 15\mathbf{X_1} – 3\mathbf{X_2}$, i.e., $\mathbf{Y} = [4\ 28\ 40\ 52]^T$, then the data set $\mathbf{Y}$, $\mathbf{X_1}$, $\mathbf{X_2}$ has the desired regression equation. However, this data set would be completely unrealistic since variable Y would be predicted perfectly from variables X_1 and X_2 and there would be no prediction error, i.e., $Y-\hat{Y} = 0$ in all cases. To make the data set more realistic we use the theory of regression which says that the error terms, $E= Y-\hat{Y}$, are not correlated with any of the predictor

variables and that the errors add to zero. If one can find a non-zero vector **E** which is uncorrelated with $\mathbf{X_1}$ and $\mathbf{X_2}$ then we show one can define **Y** as $\mathbf{Y} = 1 + 15\mathbf{X_1} - 3\mathbf{X_2} + \mathbf{E}$. In this example one possible error vector is $\mathbf{E} = [0\ 1\ -2\ 1]^T$ and one can take $\mathbf{Y} = [4\ 29\ 38\ 53]^T$ along with $\mathbf{X_1}$ and $\mathbf{X_2}$ above as the data. This data set has the specified regression equation and has non-zero error terms. The paper in the next section details how to use regression itself to compute such vectors **E**. The above **E** was computed in about thirty seconds with Microsoft Excel, the time required to type in a simple data set and run a regression.

CREATING DATA SETS WITH SPECIFIED REGRESSION COEFFICIENTS

In this part we focus on the seldom discussed fact that for a given set of independent X variables a dependent Y variable can be constructed yielding a regression equation with any set of desired coefficients. We show this is achieved by taking the error term in the regression model to be a function of vectors that are orthogonal to(uncorrelated with) the subspace generated by the **X**'s and the unit vector **I**, $\mathbf{I} = [1\ 1\ 1\ \ldots\ 1]^T$.

Suppose there are a given set of predictor variables $\mathbf{X}_1, \mathbf{X}_2, \ldots, \mathbf{X}_k$ represented as column vectors. These independent variables can even be chosen arbitrarily and can be chosen with integer values as was the case in the example in the Introduction. Suppose further we wish the regression coefficients for these chosen independent variables to be $\beta_1, \beta_2, \ldots, \beta_k$ with a particular intercept parameter of α. For teaching purposes the parameters can be taken to have integer values with any sign. To complete the data set we show it is only necessary to choose the dependent variable **Y** to have the form

$$\mathbf{Y} = \alpha + \beta_1\mathbf{X_1} + \beta_2\mathbf{X_2} + \ldots + \beta_k\mathbf{X_k} + \mathbf{E} \qquad \textbf{(1)}$$

where $\mathbf{E} = [e_1\ e_2\ \ldots\ e_n]^T$ is a variable(vector) which is orthogonal to $I, X_1, X_2, \ldots, X_k$. The definition of orthogonal between **E** and **I**, for example, is $\mathbf{I}^T\mathbf{E} = \Sigma e_i = 0$($\mathbf{I}^T\mathbf{E}$ denotes matrix multiplication). The next paragraph has the proof that the **Y** defined in Equation (1) has the desired coefficients. The paragraph after shows how to compute such vectors **E**.

The proof that the **Y** defined in Equation (1) has the specified coefficients comes from the theory of regression and from the matrix equation form of the regression equations. If we form the matrix $\boldsymbol{X}$, $\boldsymbol{X} = [\mathbf{I}\ \mathbf{X_1}\ \mathbf{X_2}\ \ldots\ \mathbf{X_k}]$ and if $\boldsymbol{b} = [a\ b_1\ b_2\ \ldots\ b_k]^T$ is the vector of estimated regression parameters then the matrix equation has the form

$$\boldsymbol{b} = (\boldsymbol{X}^T\boldsymbol{X})^{-1}\boldsymbol{X}^T\boldsymbol{Y}. \qquad \textbf{(2)}$$

This form can be found in any regression book that uses matrices, for example, Rao (1973). The **Y** in Equation (1) can be written in the matrix form $\mathbf{Y} = \boldsymbol{X}\boldsymbol{\beta} + \mathbf{E}$, where $\boldsymbol{\beta} = [\beta_1\ \beta_2\ \ldots\ \beta_k]^T$. If **E** is uncorrelated with the independent variables it is the case $\boldsymbol{X}^T\mathbf{E} = \mathbf{0}$ (for example, for two lists $\boldsymbol{x} = [x_1\ x_2\ \ldots\ x_k]^T$ and $\boldsymbol{y} = [y_1\ y_2\ \ldots\ y_k]^T$ the correlation depends on $\Sigma(x_i - \bar{x})(y_i - \bar{y}) = \Sigma x_i y_i - n\overline{xy} = 0$ and if either $\bar{x} = 0$ or $\bar{y} = 0$, which will be the case here, then uncorrelated means $0 = \Sigma x_i y_i = \boldsymbol{x}^T\boldsymbol{y}$. Then if $\boldsymbol{\beta}$ is the vector of desired regression coefficients the matrix form, Equation (2), shows $\boldsymbol{b} = (\boldsymbol{X}^T\boldsymbol{X})^{-1}\boldsymbol{X}^T\boldsymbol{Y} = (\boldsymbol{X}^T\boldsymbol{X})^{-1}\boldsymbol{X}^T(\boldsymbol{X}\boldsymbol{\beta} + \mathbf{E}) = \boldsymbol{\beta}$ is achieved.

We now show how to compute, using regression, every possible vector **E** that is uncorrelated with the independent variables. The logic behind this is based on the identity that for any vector we can write:

$$\mathbf{E} = \begin{bmatrix} e_1 \\ e_2 \\ e_3 \\ \vdots \\ e_{n-1} \\ e_n \end{bmatrix} = e_1 \begin{bmatrix} 1 \\ 0 \\ 0 \\ \vdots \\ 0 \\ 0 \end{bmatrix} + e_2 \begin{bmatrix} 0 \\ 1 \\ 0 \\ \vdots \\ 0 \\ 0 \end{bmatrix} + \cdots + e_n \begin{bmatrix} 0 \\ 0 \\ 0 \\ \vdots \\ 0 \\ 1 \end{bmatrix}. \qquad \textbf{(3)}$$

A vector such as $[1\ 0\ \ldots\ 0]^T$ is unlikely to be uncorrelated with the **X**'s but from the theory of regression if you use it as the dependent variable Y in a regression with an intercept term the resulting residuals(errors) will be uncorrelated with the **X**'s and will sum to zero. Taking every vector on the right hand side of Equation (3) as a dependent variable in regression will generate the set of all vectors **E** uncorrelated with the independent variables.

In the example in the Introduction doing this for the vectors $[1\ 0\ 0\ 0]^T$, $[0\ 1\ 0\ 0]^T$, $[0\ 0\ 1\ 0]^T$, $[0\ 0\ 0\ 1]^T$ leads to the residual vectors $[0\ 0\ 0\ 0]^T$, $[0\ 1/6\ -2/6\ 1/6]^T$, $[0\ -1/3\ 2/3\ -1/3]^T$ and $[0\ 1/6\ -2/6\ 1/6]^T$. The vectors are the same up to a scale factor and when scaled produce choices: $\mathbf{E} = [0\ 1\ -2\ 1]^T$ or $\mathbf{E} = [0\ -2\ 4\ 2]^T$ or $\mathbf{E} = [0\ 3\ -6\ 3]^T$, etc., or even $\mathbf{E} = [0\ 0\ 0\ 0]^T$.

A similar method, starting with vectors whose components already sum to zero, can also be used to produce the uncorrelated error vectors. In the general case define $\boldsymbol{\delta_1}, \boldsymbol{\delta_2},\ldots, \boldsymbol{\delta_{n-1}}$ as

$$\delta_1 = \begin{bmatrix} 1 \\ -1 \\ 0 \\ 0 \\ \vdots \\ 0 \end{bmatrix}, \quad \delta_2 = \begin{bmatrix} 1 \\ 0 \\ -1 \\ 0 \\ \vdots \\ 0 \end{bmatrix}, \ldots, \quad \delta_{n-1} = \begin{bmatrix} 1 \\ 0 \\ \vdots \\ 0 \\ 0 \\ -1 \end{bmatrix}.$$

This choice is based on the fact that any vector **E** can also be written in the form $\mathbf{E} = \bar{e}\,\mathbf{I} + (\bar{e} - e_2)\boldsymbol{\delta_1} + \ldots + (\bar{e} - e_n)\boldsymbol{\delta_{n-1}}$, where $\bar{e}$ is the average of the components of **E**. By sequentially running regressions choosing the dependent variable **Y** to be $\boldsymbol{\delta_1}, \boldsymbol{\delta_2},\ldots, \boldsymbol{\delta_{n-1}}$ (one can skip the unit vector **I** which will have errors of zero) one can produce a sequence of residual vectors $\mathbf{E_1}, \mathbf{E_2},\ldots, \mathbf{E_{n-1}}$ all uncorrelated with the independent variables and all summing to zero. As in the method above these **E** vectors will be not be independent and will be related. From linear algebra and the theory of regression (see, for example, Rao, 1973), there will be a set of n-k-1 (the error degrees of freedom in regression) vectors derived from $\mathbf{E}_1, \mathbf{E_2},\ldots, \mathbf{E_{n-1}}$ which can be used to form the vectors **E** for use in Equation (1). We will call these n-k-1 vectors the error basis vectors and denote them by $\boldsymbol{\theta_1}, \boldsymbol{\theta_2},\ldots, \boldsymbol{\theta_{n-k-1}}$. From linear algebra every possible **E** can be formed from combinations of the θ's. In the example in the Introduction we have n = 4 and k = 2 leaving n-k-1 = 1 basis vector for the error term. An example with the second method for producing **E** is given in the next section of the paper.

CONSTRUCTING A DATA SET THAT EXHIBITS MULTICOLLINEARITY

This section derives a data set with integer values and with integer regression coefficients that can be used to teach the idea of multicollinearity. There are three signs of multicollinearity (Mendehall and Sincich, 2003): 1) significant correlations among the **X**'s, 2) the correlation between **Y** and an $\mathbf{X}_i$ has one sign but the slope β_i for $\mathbf{X}_i$ in the regression equation has the opposite sign, and 3) the F-test for the fit of the whole regression equation is significant but the t-tests for the individual independent variables are not significant. To illustrate the power of the technique of the previous section we show that integer data sets can be constructed with the above properties and also with additional nice properties such as integer sample averages and standard deviations and correlations between the variables that have relatively simple rational values.

The first step in exhibiting multicollinearity is to choose a set of predictor variables that are highly correlated. Two predictor variables are chosen using the technique on page 57 of Sutrick (2006) which shows how to find data sets with integer sample standard deviations and with a range of possible correlation values. From that page, two predictor variables (with five observations) can be chosen as

$$X_1 = \begin{bmatrix} 2 \\ 4 \\ 6 \\ 6 \\ 7 \end{bmatrix}, \quad X_2 = \begin{bmatrix} 1 \\ 3 \\ 7 \\ 8 \\ 11 \end{bmatrix}$$

with $\text{corr}(\mathbf{X}_1, \mathbf{X}_2) = .96875 = 31/32$ and integer standard deviations that are reported below. The next step in the construction of the data is to find the set of all error terms **E** orthogonal to $\mathbf{X}_1$ and $\mathbf{X}_2$ that can be used to determine **Y**. This starts with the regression of $\boldsymbol{\delta_1}$ on $\mathbf{X}_1$, $\mathbf{X}_2$ and $\boldsymbol{\delta_2}$ on $\mathbf{X}_1$, $\mathbf{X}_2$, etc., yielding the following error vectors:

$$E_1 = \begin{bmatrix} 15/63 \\ -39/63 \\ 36/63 \\ 6/63 \\ -18/63 \end{bmatrix}, \quad E_2 = \begin{bmatrix} -7/63 \\ 14/63 \\ -21/63 \\ 14/63 \\ 0/63 \end{bmatrix}, \quad E_3 = \begin{bmatrix} 6/63 \\ -3/63 \\ 27/63 \\ -48/63 \\ 18/63 \end{bmatrix}, \quad E_4 = \begin{bmatrix} 8/63 \\ -25/63 \\ 15/63 \\ 20/63 \\ -18/63 \end{bmatrix}.$$

Since n-k-1 = 5-2-1 = 2, these four error vectors will be a function of two basis vectors for **E**. The first basis vector can be found by multiplying $\mathbf{E_2}$ by 63 and dividing by 7. A second basis vector was found using the technique in the Appendix below. The following two vectors

$$\theta_1 = \begin{bmatrix} -1 \\ 2 \\ -3 \\ 2 \\ 0 \end{bmatrix}, \quad \theta_2 = \begin{bmatrix} -1 \\ 4 \\ -1 \\ -6 \\ 4 \end{bmatrix}$$

can be taken as basis vectors for the error term.

From Equation (1) every potential **Y** then has the form

$$\mathbf{Y} = \alpha + \beta_1\mathbf{X_1} + \beta_2\mathbf{X_2} + q_1\boldsymbol{\theta_1} + q_2\boldsymbol{\theta_2} \qquad \mathbf{(4)}$$

Where α, β_1, β_2, q_1, q_2 can be chosen(as integers) to exhibit the second and third conditions of multicollinearity. To satisfy the second sign of multicollinearity we shall choose β_2 to be negative and then choose β_1 large enough to make the correlation between **Y** and $\mathbf{X_1}$ positive (through the large positive correlation between $\mathbf{X_1}$ and $\mathbf{X_2}$). Finally, in the consideration of the third sign of multicollinearity, q_1 and q_2 will be chosen just large enough so that the F-test rejects but the t-tests for the individual variables accept their null hypotheses. A grid search can be programmed to find appropriate integer values of these parameters(example code is in the Appendix).
Taking α=-15, β_1=11, β_2=-2, q_1=2, q_2=0 produces the data set:

$\mathbf{X_1}$	$\mathbf{X_2}$	**Y**
2	1	3
4	3	27
6	7	31
6	8	39
7	11	40

with the following summary statistics: $\bar{X}_1 = 5$ and $s_{X_1} = 2$, $\bar{X}_2 = 6$ and $s_{X_2} = 4$, $\bar{Y} = 28$ and $s_Y = 15$. Here the determined **Y** also has an integer standard deviation and the other integer valued sample standard deviations for the **X**'s result in a relatively clean correlation matrix:

Correlation	**Y**	$\mathbf{X_1}$
$\mathbf{X_1}$	.95000=19/20	1
$\mathbf{X_2}$	.88750=71/80	.96875=31/32.

The high positive correlation between $\mathbf{X_1}$ and $\mathbf{X_2}$ satisfies the first signal of multicollinearity. The second sign of multicollinearity is also present since the correlation between **Y** and $\mathbf{X_2}$ is a positive .8875, while as designed the corresponding regression slope $\beta_2 = -2$ has a negative sign. If one takes a level of significance of .10 the P-value of the F-test for this data is .0800 so that the F-test rejects the null hypothesis: $\beta_1 = \beta_2 = 0$, implying that at least one of the independent variables is relevant. The t-test for the null hypothesis: $\beta_1=0$ has a P-value of .2105 and accepts the null, while the t-test for the null hypothesis: $\beta_2=0$ has a P-value of .5763 also accepting the null, implying that neither $\mathbf{X_1}$ nor $\mathbf{X_2}$ is relevant for predicting **Y**. The three signs of multicollinearity are exhibited and in addition all

variable averages and sample standard deviations take on integer values. This data set makes it easier to explain the idea of multicollinearity by using a simple form for the regression equation. This particular data could also be scaled(by multiplying by a constant and by adding a constant) to fit a housing price scenario.

This data set illustrated multicollinearity at a significance level of $\alpha = .10$. By increasing the sample size, giving more degrees of freedom to the error term, one can use a lower significance level such as $\alpha = .05$ or even lower to do the illustration.

CONCLUSIONS

In the teaching of multiple regression to students with non-mathematical backgrounds it is possible to produce hypothetical data sets where the student's attention is focused not on calculations but on the regression ideas the instructor is trying to make. This is accomplished by creating integer data sets where regression equations have integer coefficients. The key to deriving such data sets is to pick appropriate independent variables and to then find an error term for **Y** which is uncorrelated with the **X** variables chosen. The construction process is really not that difficult. A data set with nice properties illustrating multicollinearity is derived in the paper.

After beginning the teaching of regression with constructed data sets to illustrate the various concepts involved, real data sets can then be introduced and discussed with greater clarity.

APPENDIX: COMPUTER CODE

There are two calculations in the paper that can be facilitated with programming. The first is finding the basis vectors $\boldsymbol{\theta_1}$ and $\boldsymbol{\theta_2}$ for Equation (4). The second calculation is searching for the parameter values α, β_1, β_2 , q_1, q_2 that determine **Y** in (4). The procedure and computer code for the first calculation is discussed here with appropriate modifications for the second calculation indicated at the end.

The data set above has two basis vectors with the first basis vector already chosen. A second basis vector could be chosen by multiplying $\mathbf{E}_1$ by 63 and dividing by 3 giving

$$\theta_1 = \begin{bmatrix} -1 \\ 2 \\ -3 \\ 2 \\ 0 \end{bmatrix}, \quad \theta_2 = \begin{bmatrix} 5 \\ -13 \\ 12 \\ 2 \\ -6 \end{bmatrix}$$

as the basis vectors. Ideally one would prefer small numbers as components of the error basis vectors. This can be accomplished by taking (linear)combinations of the (scaled) **E**-vectors in the form $i_1\mathbf{E}_1 + i_2\mathbf{E}_2 + i_3\mathbf{E_3} + i_4\mathbf{E_4}$.
The following Excel Macro finds the combinations using the two θ-vectors above as the error vectors(i_3 and i_4 can be taken as zero since only two **E**-vectors are needed to get two basis vectors).

```
Sub GetBasis()
Dim E(1 To 5, 1 To 2) As Integer          ' E will contain the regression error (column)vectors.
Dim B(1 To 5) As Integer                  ' B will be potential basis vectors
Dim Range As Integer                      ' Range determines the number of combinations of the E's
n = 5                                      ' n is the number of observations
ncol = 2                                   ' ncol is the number of error vectors
Range = 2                                  ' Range = 2 lets the i's go from -2 to 2
For i = 1 To n
For j = 1 To ncol
E(i, j) = Cells(i, j).Value               ' These lines of code read the error vectors into the Macro
Next j
Next i
Count = 0                                 ' Count is an index for which column the next basis vector is printed
For i1 = -Range To Range
For i2 = -Range To Range
```



```
Count = Count + 1
For i = 1 To n
B(i) = i1 * E(i, 1) + i2 * E(i, 2)              ' This line forms combinations of the error vectors
Cells(10 + i, Count).Value = B(i)              ' This line prints potential basis vectors to the Worksheet, Row 10
Next I
Next i2
Next i1
End Sub
```

In the For-Next loops when i1 = -1 and i2 = -2 the Macro prints

$$\begin{bmatrix} -3 \\ 9 \\ -6 \\ -6 \\ 6 \end{bmatrix} \quad \text{or when scaled gives} \quad \begin{bmatrix} -1 \\ 3 \\ -2 \\ -2 \\ 2 \end{bmatrix}$$

as a possibility for the second basis vector. This second basis vector can also be made perpendicular to the first vector by using the main regression technique above. Take $\mathbf{Y} = [-1 \;\; 3 \;\; -2 \;\; -2 \;\; 2]^T$ and $\mathbf{X} = [-1 \;\; 2 \;\; -3 \;\; 2 \;\; 0]^T$ in a simple regression which then has the residual vector

$$\begin{bmatrix} -.5 \\ 2 \\ -.5 \\ -3 \\ 2 \end{bmatrix} \quad \text{which when scaled gives} \quad \begin{bmatrix} -1 \\ 4 \\ -1 \\ -6 \\ 4 \end{bmatrix}$$

as the second basis vector, as was used previously. If there are three or more basis vectors for the error term the Macro would be modified by adding more For-Next loops. A modification of the Macro can be used to compute the **Y's** in Equation (4) as well. The ***X***-matrix would have to be read into the Macro and the line: B(i) = i1 * E(i, 1) + i2 * E(i, 2) would need to be changed reflecting Equation (4).

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An Experiential Production Exercise with LEGO cars

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ABSTRACT

This paper describes an in-class exercise designed to teach production and operations management principles using an automotive production exercise with LEGO CITY! Small Cars. The exercise is designed to be accomplished in one to two class periods and teaches basic production concepts like process improvements, lean manufacturing, cycle time reduction, mass customization, pull production strategies, supplier capacity, 5S, jadoka, heijunka, kanban and kaizan. An explanation of the classroom exercise along with lessons learned is presented.

Keywords: Production exercise, simulation, process improvement, lean manufacturing, cycle time reduction, mass customization

INTRODUCTION

Teaching production and operations management principles to business students can often be a difficult task. Since most students do not have access to production facilities for experimentation, classes in production and operations management tend to be more theoretical in nature. Experiential exercises used in the classroom can be quite useful in illustrating complex production issues (Alhourani, 2008; Ashenbaum, 2010; Billington, 2004; Miles, Melton, Ridges, & Harell, 2005; Penlesky and Treleven, 2005; Piercy, 2010; Reyes 2007; Swanson, 2008; Vaughan and Gardner, 2009). This paper will describe an automotive production exercise using LEGOs that allows students to understand the value of training, written and visual instructions, proper communication, as well production concepts such as process improvement, lean manufacturing, cycle time reduction, mass customization, pull production strategies, supplier capacity, 5S, jadoka, heijunka, kanban and kaizan.

SET-UP PREPARATION FOR THE EXERCISE

18 LEGO CITY! Small Cars (See Figure 1) were purchased, and three subassemblies were Super-Glued together, including the front-end, frame and seat (See Figure 2). The front end and side door panels of eight cars were painted, four purple, representing a sport model, and four green, representing a hybrid model. The remaining ten cars were left unpainted (white) to represent a standard version of the car. Four sets of tire rims were painted black and four sets of tire rims were painted gold with the remaining rims left as standard gray, representing three different tire packages. All the parts necessary to produce a single car, except for the tires, were bagged together. The tires for the 18 cars were split into two bags, each containing nine full sets of tires, including two black sets, two gold sets, and five gray sets.

LEGO EXERCISE

Round one – training and introduction

Students in a supply chain management class at a small, private, mid-western university were the subjects that pilot-tested this exercise. In this stage of the exercise, students were split into six groups of three to four. Each group was given the original box from the LEGO CITY! Small Car, one bag containing all subassemblies needed to produce a single car, and a bag of four tires. No instructions, visual or written, were given to the groups, and the task was to build the car as fast as possible using the box as the model. To complicate matters, each group was given five extra parts that did not belong to the LEGO CITY! Small Car set. No time limit was set, and the task was to build the car as fast as possible, with the two measurables being cycle time (the time taken to build each car) and quality (did the finished product look like the box). During this first round of the production exercise, the groups finished in anywhere from three to seven minutes. Some of the groups had quality issues that were discovered upon delivery of the car to the instructor, and in those cases the car was sent back to the group for rework.

Immediately following Round One, students were debriefed, and asked for feedback on lessons learned. Some of the issues that the students identified as being important during this round were how the lack of proper training and

written or visual instructions hurt their cycle times. Students also mentioned that they were at the steep end of the learning curve, which negatively impacted both cycle times and quality, as they had never seen or assembled the LEGO CITY! Small Cars before. The 5S methodology – sorting, straightening, shining, standardizing, and sustaining - was also discussed with emphasis on how sorting and straightening would lead to reduced cycle times.

Immediately following the debriefing, students were given five minutes to practice building the cars again, and were encouraged to ask the instructor for tips on improving the assembly process.

Round two – assembly line production

During the 2nd round, students were arranged in groups of six, with three assemblers, two disassemblers and one quality control worker. Each group was given ten bags; nine bags contained subassemblies to complete an entire car, and one bag contained the tires necessary to build nine cars. Five extra parts were again thrown into the bags such that there were more parts than were necessary to build the cars. The groups were given five minutes to prepare for the exercise, and demonstrated that learning had occurred from Round 1 as they sorted or rid the bags of excess parts, and organized the parts in an effort to improve efficiency and reduce cycle times.

The task in this round was to make as many cars as possible in five minutes. Once a car was manufactured, the quality control worker would check the car and pass it along to the instructor for final inspection. All cars that passed final inspection were counted, and the assembled cars could be disassembled and reassembled by the group. Measurables in this round could include the number of vehicles produced, cycle times, scrap – or the number of cars that did not pass initial inspection (first run yield), and the number of work in process vehicles.

With increased experience in building the cars, knowledge of the production process, lessons learned from Round One and specialization in tasks, it is no surprise that cycle times were reduced when compared to Round One. In this round, cycle times ranged from 24-72 seconds per vehicle.

During the debriefing session following Round Two, the instructor discussed the following issues: jadoka or quality at the source. It is not just the job of the quality control person to check for quality problems, but the responsibility of everyone on the line - defects do not get passed on to the next process. Process improvements made from Round One were discussed, including the benefit of having the five minute period prior to Round Two to prepare for production. Students identified bottlenecks in the process as well as an unbalanced work load between the roles, which then led to a discussion of heijunka which is the process of production smoothing or leveling. The idea of kanban, which is a production scheduling system, was also introduced to describe how a pull production system leads to a reduction in work in process.

Immediately following the debriefing, students were given five minutes to discuss potential process improvements and told that for Round Three they would be given instructions for 20 build-to-order cars.

Round three – build-to-order-cars – mass customization

The cars that were to be manufactured had four different options: 1) Model of car – standard, hybrid, sport , 2) Tire Package – standard gray, gold, or black, 3) Headlights – Yes or No, and 4) Grille – Yes or No. Students were given the same five-minute planning period and had the same roles that they selected in Round 2, with three assemblers, two disassemblers, and one quality control worker. The task was to build the 20 made-to-order vehicles as fast as possible with as few quality issues as possible. Cars have to be built in the order of the instructions received (See Table 1), and each order was placed on a three-by-five index card that was cut in half (See Table 2). Both the finished car and the order instructions had to be submitted to the instructor for final approval.

In order to simulate the impact of supplier capacity issues on the production process, there were four orders to produce either sport or hybrid cars in a row, but only parts necessary to build two of these vehicles at any given time. Thus, the line was starved and the assemblers could not start the third hybrid vehicle until the first hybrid car was completed and disassembled. The same issue was raised by having the groups build four straight cars with either the gold or black tire package, when there were only enough tires to build two of these cars at any given time. Despite the supply and customization issues, cycle times for both teams were reduced when compared to Round 2. Each group finished 20 cars within a ten-minute time frame, so cycle times were under 30 seconds per vehicle.

One of the first points of discussion during the Round 3 debriefing was supplier capacity issues. These related to the orders where there were not enough parts on hand to build all of the cars without first disassembly of the previous built cars. If the required inputs are not on hand when production begins, this can lead to work stoppages and unnecessary delays. Students indicated that by balancing the orders in the exercise, these supplier shortage issues would be reduced. This raised the issue of the value of reliable suppliers in practice, as without dependable suppliers, lean manufacturing is not possible.

The next point of discussion was how improved communication among the group members could lead to shorter cycle times. In this exercise, information about which model car was to be built was yelled out by the first person who saw the order so that all group members would know which car was coming down the line. In practice, a company's information system would give all production team members similar information in real time.

The final issue discussed in the 3rd debriefing session was that of kaizan or continuous improvement. Even with build-to-order cars the teams were able to reduce cycle times, showing that the teams had moved down the learning curve and were improving after each round of the exercise. The debriefings after each round and the planning process preceding each round allowed the students to alter their production techniques to better suit the task at hand.

During the time period after Round 3, students were told that in Round 4 they would make ANY improvements necessary to decrease cycle times. Students were given the note cards with the orders in advance so they could use a mixed planning / scheduling approach. The final announcement was that the options package had been consolidated such that the upgrade package would include a grille and headlights, while a standard package would not include either of these enhancements. This is typical of what would be seen in an actual manufacturing setting, as it reduces the number of variables that need to be considered for each build-to-order car.

Round four – further cycle time reduction – final stage

The instructors wrote the orders for Round Four on the reverse side of the note cards that had the orders for Round Three. The only difference between the orders was that the cars were to be built either with the upgrade package – grille and headlights, or the standard package – no grille or headlights. The models and the tire packages remained the same, leaving the students with only three variables to consider for each order.

The students were also given the orders in advance of production and were allowed to arrange the orders in a way that would minimize cycle times. This mixed planning scheduling technique eliminated the capacity issues that occurred in Round 3. Students were also informed that they could take on any role that would help reduce cycle times, instead of being locked into a particular role as in Round 2 and 3. Because of this, students were able to learn about the concept of heijunka where the production line and workloads (bottlenecks) between the students were more evenly balanced.

Cycle times in Round Four were the lowest of any round, which came as no surprise. With each round the students moved down the learning curve and were able to apply the concepts learned in the debriefing sessions. The planning stages before each round also helped with the preparation for the production process. Freeing the students from their roles and asking them to make any improvements they deemed necessary led to cycle times that were better than ever, and cars that had fewer defects than previous rounds.

CONCLUSION

Students performed an experiential exercise in production using LEGO cars, but came away with a greater understanding of important production concepts.

Round 1 taught the idea of cycle times, continuous improvement, demonstrated the importance of both written and visual instructions and proper training, and led to a discussion of the 5S method of production.

Round 2 illustrated the topics of jadoka, heijunka and kanban. Students identified and put into action process improvements from Round 1.

Round 3 introduced the idea of build–to-order production (mass customization) and how supplier issues could impact productivity and cycle times. The importance of proper communication was illustrated as well as the idea of kaizan or continuous improvement.

Round 4 is the time that the students implemented all of the improvements from the first three rounds, moved further down the learning curve, and produced high-quality cars in the least amount of time during the entire exercise. They learned that by minimizing the number of options from which consumers could choose led to increased productivity, while still giving the customers what they wanted. The students used mixed planning scheduling techniques to improve efficiency and heijunka to balance the work flow.

The exercise was conducted in a three-hour block class and actually took one and a half hours to complete. This exercise could easily be split up into two 50-minute class sessions, or for well organized instructors could feasibly be done in a 75-minute class.

The preparation work of gluing and painting the subassemblies as well as writing up the orders for Rounds 3 and 4 took one afternoon, and the benefits far outweighed the costs. The students were buzzing about the exercise and were talking about it in other classes the next day. Topics that were not easily conceptualized from the textbook were brought to life with this exercise in production concepts using the automotive industry as the class example.

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Figure 1 – LEGO CITY! Small Car – Glued Subassemblies

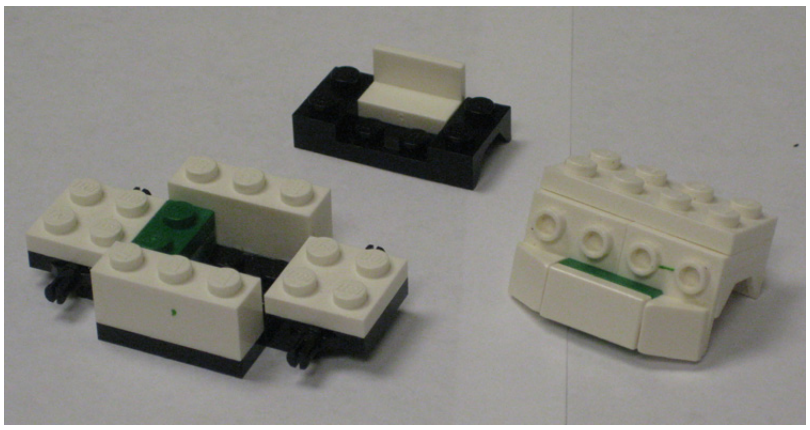

Figure 2 – LEGO CITY! Small Car – Completed Car – Hybrid Version

Table 1 – Order Specifications for Rounds Three and Four

Round Three

Car	Model	Tire Package	Grill	Headlights
1	Purple	Gray	Yes	Yes
2	White	Gold	Yes	Yes
3	Green	Gray	Yes	Yes
4	Green	Black	Yes	No
5	Green	Gray	Yes	Yes
6	Green	Gray	No	No
7	White	Black	No	No
8	White	Black	Yes	Yes
9	White	Black	Yes	Yes
10	White	Black	No	Yes
11	White	Gray	Yes	Yes
12	Purple	Gray	Yes	Yes
13	Purple	Gray	Yes	Yes
14	Purple	Gray	Yes	No
15	White	Gray	Yes	Yes
16	White	Gold	Yes	Yes
17	White	Gold	Yes	Yes
18	Green	Gold	Yes	Yes
19	White	Gold	Yes	Yes
20	Purple	Gray	No	No

Round Four

Car	Model	Tire Package	Upgrade Package
1	Purple	Gray	Yes
2	White	Gold	Yes
3	Green	Gray	Yes
4	Green	Black	Yes
5	Green	Gray	Yes
6	Green	Gray	No
7	White	Black	No
8	White	Black	Yes
9	White	Black	Yes
10	White	Black	Yes
11	White	Gray	Yes
12	Purple	Gray	Yes
13	Purple	Gray	Yes
14	Purple	Gray	Yes
15	White	Gray	Yes
16	White	Gold	Yes
17	White	Gold	Yes
18	Green	Gold	Yes
19	White	Gold	Yes
20	Purple	Gray	No

Table 2 – Sample Note Cards With Orders For Rounds Three and Four

CAR 1
MODEL – PURPLE TIRES – GRAY GRILL – YES HEADLIGHT - YES

CAR 1
MODEL - PURPLE TIRES - GRAY UPGRADE PACKAGE - YES

Undergraduate and Graduate Project Management Development Using *Microsoft Project*

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ABSTRACT

A term project using *Microsoft Project* is beneficial to developing undergraduate and graduate student understanding of project management concepts, tools and techniques as well as student professional development in project planning, writing and oral presentation. At the undergraduate level, the project requires students to develop the plan for a hypothetical project and includes developing project cost and resource plans, while graduates working in teams must simultaneously develop two projects using a common resource pool. Over six undergraduate and four graduate course offerings, over 91% of 173 students indicate the positive value to learning project management through this project. Undergraduate students are even more positive (98.7%). Graduates responses are less positive (84.9%), potentially due to the team requirement, simultaneous planning, and/or additional common resource pool complexity at this level.

Keywords: project management, instruction, project

INTRODUCTION

Project management courses are, and have been, an important part of many business and engineering programs for several decades. Executives continue to emphasize the increasing need for project management skills [Hoffman, 2007; Pant & Baroudi, 2009]. In recent years as globalization increases, project management concepts, tools and techniques continue to rise in importance in other parts of the world - from India [Murthy, 2006], to the Middle East [Al-Maghraby, 2008], to South Africa [Gerryts, 2007], to New Zealand [Pewhairangi, 2010] and the Pacific Rim, Eastern Europe and Latin America [Smith, 2003]. In fact, since the trend for project management is globalizing, the International Organization for Standardization (ISO) is developing a global standard for project management (ISO 21500) that builds upon the Project Management Institute (PMI) standards while incorporating specific project manager competencies and interpersonal skills deemed necessary by the various international standards organizations [IHS, Inc., 2007].

By definition, a project is an interrelated set of activities, having a definite starting and termination point and resulting in a unique outcome for a specific resource allocation operating under a triple constraint - time, cost and performance [Krajewski, Ritzman & Malhotra, 2010]. A project is a complex, non-routine, one-time effort limited by time, budget, resources, and performance specifications designed to meet customer needs [Larson & Gray, 2011]. Project management "is the planning, organizing, directing, and controlling of company resources for a relatively short-term objective that has been established to complete specific goals and objectives" [Kerzner, 2006, p. 4]. Project Management tools and techniques are multi-functional and require extensive planning and coordination to address complex, unique projects operating under the triple constraint - time, cost and performance. In the past few decades, the use of project management to achieve organizational goals has increased rapidly [Meredith & Mantel, 2009], and many business and engineering schools have responded with courses to assist students in learning these unique skills.

Project management requires individuals to utilize both technical and managerial skills. Instructors have a variety of different options to teach these skills, ranging from the traditional, lecture-based passive-learning, skill-based exercises, technology-enhanced methods, to inquiry-based cases and projects [Volkema, 2010]. Each of these methods has its time and place in educating students, and can be used individually or in groups. For instance, the traditional, lecture-based method is preferred with less-experienced students who require more structure [Fish, 2007]. Group-learning offers the added benefit of self-critique and critical reflection [Volkema, 2010]. The use of inquiry-based case studies and projects to aid student learning is a well-established business management practice used by instructors to add a real-life perspective for students. Project management instructors are encouraged to use active learning or experiential learning activities to enhance life-time learning [Cook & Olson, 2006; Divjak & Kukec, 2008; Ehie, 2001; Walters and Marks, 1981; Wright and Ammar, 1997]. Active-learning allows the student to have more control over his learning while supporting cognitive, motivational and emotional development

[Volkema, 2010]. Recent project management educational literature cites using active or experiential learning activities such as an in-class building skyscraper activity to explore qualitative and quantitative issues in projects [Cook & Olson, 2006], additional online after-case activities for an international doctoral program [Divjak & Kukec, 2008], and a multimedia case study including audio and video clips and photos to explore public project selection [Elrod, Murray, Flachsbart, Burgher & Foth, 2010].

Project-based learning assists with driving learning, construction of a concrete artifact, self-pacing, an authentic learning environment, and multiple forms of representation [Helle, Tynjala, & Olkinuora, 2006]. When completing projects, instructors need to be keenly aware of the semester length and ability for students to actually complete the work at hand. In order to complete projects in her project management course, Professor Barbara Withers at the University of San Diego requires students to learn the academic material through distance learning and the actual team-based project is completed during class [Volkema, 2010]. Work-based project learning brings additional value to students through planning the whole project, and a general, practical view of the entire project process [Tynjala, Pirhonen, Vartiainen & Helle, 2009]. In particular, a study of project managers indicates the critical lesson that students should understand how the entire project is managed in real life - that is, the diversity in terms of types of projects, management, and technical issues [Tynjala et al, 2009]. They cite the need for students to plan the whole project, manage the processes and critical work tasks, and develop costs and resources. Students self-select projects to plan, which in theory, increases their commitment to active learning [Volkema, 2010]. This is particularly evident when students self-select projects of personal interest to their current or future plans.

In recent years, project management instructors integrated service-learning with project management. Small, community-service projects may be completed as part of an MBA orientation program [Volkema, 2010]. In one course, fund raising projects are managed by teams with 6 key deliverables throughout the semester [Larson & Drexler, 2010]. The project emphasis is on building leadership and teamwork skills while promoting citizenship and social responsibility. Although students' responses are extremely positive, the instructors note the difficulties with delivering traditional project management concepts, such as the student's lack of understanding resource leveling and earned value analysis through this project. One of the most innovative and recently published articles on teaching project management integrates service-learning and project management into an engineering course [Dixon, 2011]. Students in the service-learning project management course perform service projects while collaborating on engineering design, presenting academic material, treating the classroom as an organization, performing peer reviews, and reflecting upon project management learning. While post-course student evaluations demonstrate a positive experience, the instructor notes the significant time commitment to the methodology as a key drawback. Other drawbacks to the service-learning, project management course include the lack of financial and risk experiential learning, issues regarding student safety and lack of project selection criteria, differences between outside stakeholders and project fit with course goals, *Microsoft Project* learning difficulties, and evaluation process issues.

We continue our discussion on the project uniqueness and curriculum requirements. Then, we present the projects - both undergraduate and graduate, project integration into the classroom experience, and project effectiveness. We conclude with a discussion on the project merits.

PROJECT UNIQUENESS

As previously discussed, projects are an integral teaching mechanism in many courses in business and engineering. *So, what makes the project described here unique?* The project can be used for both graduates and undergraduates, directly integrates classroom theory into application, requires *Microsoft Project 2007* utilization, requires students to *completely plan* a project, encourages active learning, and professional development.

At the undergraduate level, each student is expected to fully develop a single, unique, hypothetical project, whereby the project value must be in excess of $ 10,000, involve at least three full-time people (with the student as the project manager), and take at least 3 months to complete. Graduate students must fully develop two simultaneous project using a common resource pool, where the value of the combined projects must be in excess of $100,000, involve at least five full-time people used on both projects, and take at least 6 months to complete. Graduates work in two-person self-selected teams to complete the planning for both projects using the common resource pool. At both the graduate and undergraduate levels, as topics are introduced in the classroom, students simultaneously integrate the terminology, techniques and concepts into their projects, which enhances the learning process. For example, when

the instructor introduces the concept of the Statement of Work, the following week, students submit a preliminary Statement of Work as part of their project proposal. Also, students learn and simultaneously utilize *Microsoft Project 2007* in project development. Another unique project feature is the project plan development through specifically addressing relevant project development issues - such as project team composition and the "hypothetical" sponsoring firm. Through answering each project question, students develop the qualitative aspects of the projects simultaneous to developing the working *Microsoft Project* plan for the project. Hence, students learn the basic issues that every project must answer in project development. Finally, although not unique to this project, student professionalism is improved through the written report and final project presentations.

THE PROJECT MANAGEMENT COURSE

Project Management courses, where the project is used, exists at both the graduate and undergraduate levels as electives at a northeastern, private, AACSB-accredited college. Smaller class sizes (less than 30) are recommended for this project. The undergraduate course, which has been taught by an individual instructor six times in the past 15 years, seeks to introduce students to the principles, techniques and issues of project management. The course objective is to teach students project management planning throughout the entire project life cycle - from initiating, planning, execution, monitoring and controlling, to termination and close-out. These correspond to the five distinct processes noted by the Project Management Institute [PMI, 2008]. Specific concepts covered during the course include the nine knowledge areas outlined by the Project Management Institute: project integration, project scope, project time, project cost, project quality, project human resources, project communications, project risk management, and project procurement [PMI, 2008]. Course performance is measured through the project (30%), case studies (30%), quizzes (30%), lab computer assignments (5%) and individual participation (5%). As an undergraduate elective, the course does not directly test, but supports, the major's learning goals and objectives, which are tested in the senior year. Specific major learning goals and objectives that the course contributes to student learning include: (1) ability to solve problems in operations management using management science techniques and interpret results, and (2) knowledgeable about leadership and organizations through leadership theory development, motivation development, and organizational structure and design.

The graduate course, which has been team-taught three times by members of the management and information systems department, has similar goals and objectives to the undergraduate program with the additional emphasis on constrained resources through a shared resource pool and project teams. Similar to the undergraduate course, the project life cycle and nine knowledge areas promoted by the Project Management Institute are emphasized in the course. Graduate course performance is measured through the project (40%), case studies (30%), midterm (15%) and final (15%). As a graduate elective, the course does not directly relate to, but supports, the program learning goals. Specifically, the course reinforces the graduate program learning goals and objectives to: (1) understand global operations management through value creation, (2) apply quantitative methods, (3) understand human behavior in a global context, (4) understand how information technology supports business strategy and operations, and (5) understand conventional and innovative approaches to leadership and group dynamics. Similar to the undergraduate assessment, an exit assessment for these objectives confounds specific course assessment on these objectives. The use of teams to complete the project adds the development of the human resource issues in projects and requires students to develop their group and leadership skills to complete the project.

THE PROJECT

At the undergraduate level, students are expected to develop a project plan - from statement of work, through work breakdown structure, to timing, resources and costs, until the entire project plan is completed. *Microsoft Project* is a requirement for project completion, as well as a formal written report (80%) and presentation (20%). In the report, the student addresses specific issues pertinent to project development as shown in the Figure 1. To complete the project, the student uses his textbook (Gido & Clements (2009) *Successful Project Management, Fourth Edition*), *Microsoft Project*, classroom discussions, instructor guidance, and additional readings highlighted through classroom discussions. Students self-select projects, and many select projects that have a personal meaning to them, such as a charity balls, political campaign or golf dome construction, which adds an additional dimension to the project. Thus, the project provides a methodology to incorporate application-based learning into classroom learning while meeting educational goals. The instructor grades each project on the issues outlined in Figure 1 - project justification, description of the "firm" and project team, planned approach (including statement of work, work breakdown structure, resource utilization, and budget), deliverables, contingencies, and executive summary. Each

student must completely address each issue or the instructor penalizes the project appropriately. The instructor also grades the project on professional business writing, adequate depth, application, proper terminology, integration of plans, and creativity. Student presentations are graded based upon organization, ability to convince the audience to back the project, clarity, triple constraint presentation, pertinent contingency planning, incorporation of project management issues, and professionalism. Students are advised to select specific *Microsoft Project* reports that depict their project, summarize them within the report and include the actual *Microsoft Project* report in an Appendix. Students are encouraged to seek assistance from their instructor with any information systems or report issues. The project is due the last week of classes, when the classroom presentations also occur.

Figure 1: Project Management Project

Undergraduate Project Management: Individual Term Project

Your semester project is to fully develop the concept or idea of a project. (Some suggestions for a project are below.) This project idea is to be submitted to me by XXXX. In general, the estimated dollar value of the project must be in excess of $10,000, involve at least three full-time people over its duration (with you as the project manager), and take at least 3 months to complete.

Purpose:

1) Develop project plan: The purpose of the project is to fully develop a project plan, including the statement of work, work break down structure, timing, and associated costs for a project.
2) Utilize Microsoft Project: The student will be expected to utilize the computer, specifically Microsoft Project, to develop their solution.
3) Write a traditional business report on the project: A business report, not an essay, is required as designated below.
4) Present the project: Professional presentation on highlights of their project, similar to a project proposal, is required as outlined below.

The project will be due when the student presents the individual project**, beginning on YYYY**- NO EXCEPTIONS. It is strongly recommended that the student consciously be working on the project throughout the semester. Each student will submit a one-page write-up of the project topic by XXXX. Failure to submit a write-up will result in 5 points deduction per week from the final project grade.

Potential Project Ideas:

1) College Senior Class gift.
2) Building or renovating an apartment/house or restaurant.
3) Building a miniature golf course.
4) Modifying a facility layout.
5) Running a political campaign.
6) Planning and running College International Festival.

Grading: You will be expected to hand in a written report, make an individual presentation to the class and will be graded as noted below. It is expected that MS Project reports will be included in the APPENDIX of your report.

Graduate Project Management Project

Your semester project is to **fully develop two projects that share a common resource pool**. In general, the estimated dollar value of the project must be in excess of $100,000, involve at least five full-time people over its duration, and take at least 6 months to complete. The project is to be completed in **groups of two**. Students will choose their own groups. This project idea is to be submitted by XXXX.

Potential Project Ideas:

1) Building or renovating 2 apartments, house or restaurant (or some combination).
2) Building a miniature golf course and associated restaurant.
3) Modifying a facility layout and dock area.
4) Planning and running college International Festival and graduation.

Project Management Report

The report will count for 80% of your project grade. The report will be graded upon its depth, application, integration, and appropriate analyses. It should be integrative and well-written.

REQUIRED REPORT FORMAT:

Use the following headings and sub-headings (per questions) for your report:

I) **Executive Summary [10 points]**: The plan for the project is SUMMARIZED and the triple constraint addressed. Note this is the first page following the title page and is less than 1 page long.

II) **Project Justification [10 points]:** *What is the need for the project?*
- Define the need for the project. Why are you doing the project? Who will benefit from the project? Who is the customer?
- Develop a Statement of Work (SOW).

III) **Description of the "Firm" & Project Team [10 points]:** *Who is doing the project?*
- Firm: Describe the "firm" (past history of the "firm"). What is the organizational structure for the project within the firm?
- Project Manager: Who is the project manager? What qualities of the project manager will make it successful?
- Team: Who is on the project team and why? Include a Linear Responsibility Chart: What are the responsibilities of each member?

IV) **Planned Approach [35 points]: Develop the detailed plans for your project. Discuss the plans in the report (summarize them). Include the following in your report and the specifics in an Appendix.** ***What is the plan for your project? This is the 'heart' of the class project.***
- Work Breakdown Structure (WBS) in MS Project
- Gantt chart including milestones, durations, start/finish, resources and costs. Start and finish dates of the project. (Do NOT print out PERT network in Microsoft Project.)
- Cost summary and appropriate analysis (Why should management back this project financially?)
- Resource summaries for critical resources.

Utilization of MS Project is a requirement for this phase of the project! The main body of the report **should not** contain the printouts from Microsoft Project. Please place these in an Appendix to show your depth in planning and include SUMMARIES of the critical aspects in your report and presentation.

V) **Deliverables / Contingencies [10 points]:**
- Are there any legal issues specific to the project? Outline these.
- What are 3 potential, realistic problems with the project? Outline potential contingencies for EACH of these problems.
- What are the critical aspects that need to be monitored and controlled for the project?

Other Grading Issues [5 points]:

1. Professional, well-written (proper grammar, spelling, and punctuation) report that includes the appropriate project management terminology. Creativity will also be noted.
2. Depth - the ability to show that you understand the issues at hand and answer the question in a relevant manner. Where applicable, you may wish to give two or more issues associated with each question.
3. Application: the ability to apply the concepts we used during the semester.
4. Integration: the report should "fit" together. That is, the report should clearly demonstrate how the qualitative portions of the report fit with the quantitative portions.

5. Analysis: Appropriate analyses when necessary. PLEASE NOTE SUMMARY CHARTS AND TABLES OF RELEVANT RESULTS SHOULD BE INCLUDED IN THE BODY OF THE REPORT, WHILE SUPPORTING DOCUMENTATION SHOULD BE IN AN APPENDIX.

If you have any questions on the level of detail, formats or expected standards for your independent project, please do not hesitate to contact me. Other project particulars include project format and organization. The page length (maximum of 10 total, double-spaced, typed pages), character size (12 point Courier or Times New Roman), and page layout (1 1/4 margins on each side with an inch at the top and bottom) guide the student on response depth.

Project Presentations

The individual presentations will account for 20% of your individual project grade. The presentation will be graded upon your ability to present and communicate the relevant issues to the project in a professional manner in the time allotted. Your presentation should try to "sell" others your proposal as a viable project which has been thoroughly planned. Time limits are as follows: minimum time - 7 minutes, maximum time - 12 minutes, including 2-3 minutes for questions and answers. You will be graded upon the following:

1) Organization: Your presentation should be well thought out. It should not be a "last" minute activity. You may wish to practice it at least once before you actually do it. Don't forget to introduce the outline of the presentation and allow for questions.
2) Ability to convince audience to back your project: The audience should be able to clearly see how you will accomplish your project. Although you are not competing against each other, many times proposals are in competition. You need to be very convincing in your presentation that your project is a viable project, where you have considered all of the risks.
3) Triple Constraint Presentation: Your presentation MUST clearly address the Triple Constraint.
4) Incorporation of Project Management issues: Other PM issues, such as labor and resources should also be addressed in your presentation.
5) Pertinent Contingency Planning: Your presentation should include a discussion on the risks associated with your project and some viable options to overcome these should they occur.
6) Professionalism: A professional presentation, with appropriate displays, is expected. (Hint: If you had an actual job, what type of presentation would you present to your boss?) Look-up and try not to read your presentation to the class.
7) Time management: Use time appropriately. Your presentation should last at least 6 minutes, but no more than 10, with at least 2 minutes for questions.

As for the graduate project, the project is very similar except students are expected to complete the project in teams and to develop two simultaneous projects using a common resource pool as outlined in Figure 1. (Also, since the depth is different between the two programs, graduates use Meredith & Mantel (2009) *Project Management: A Managerial Approach, 7th Edition*.) The students are allowed to self-select their project teams (2 to 3 students) as well as their similar, but *different*, hypothetical projects to develop. Typical simultaneous projects have included accounts payable system implementation in conjunction with bank branch opening, and new house construction in conjunction with warehouse reconstruction. Students are not allowed to develop two of the same projects - such as two houses - simultaneously. At the graduate level, the project is unique as a common resource-base must be used to simultaneously develop two projects. Students are taught *Microsoft Project* skills to accomplish this - particularly during resource leveling, and classroom discussions address the complex resource issues surrounding this task. Graduate students are required to submit a professional business report (80%) and presentation (20%).

PROJECT INTEGRATION INTO THE CLASSROOM EXPERIENCE

As previously mentioned, topics covered in both courses mirror the PMI [PMI, 2008] five distinct processes for a project life cycle and the nine knowledge areas, although the depth differs. The tentative schedule for the 15-week semester is outlined in Figure 2. Students are introduced to and develop *Microsoft Project* skills to plan, monitor and control projects. Lab experiences, simultaneous to classroom discussions, are scheduled at critical times throughout the semester. While students continue to develop their projects, classroom discussions turn to monitoring and controlling using *Microsoft Project,* as well as report relevance and creation. Finally, students baseline their projects, complete their reports, and present their unique projects to the class. The project requires the student to apply classroom terminology and concepts to the development of projects. It specifically "walks" the student through basic plan development as the classroom experiences build the qualitative and quantitative project plans. Through activity-based learning, students experience the academic concepts.

Figure 2. Tentative Course Schedule

Week	Topic & Chapter	Assignment Due
1	Project Management Concepts	
	Project Management Concepts / Needs Identification	
2	Needs Identification	
	Proposed Solutions	Assignment #1
3	Proposed Solutions / The Project	
	The Project	Quiz #1
4	Planning	Project Proposal Due
	Planning	Assignment #2
5	Scheduling	Quiz #2
	Computer Lab Session – Planning	Computer - Planning
6	Scheduling	Assignment #3
	Computer Lab Session – Scheduling	Computer - Scheduling
7	Resource Considerations	Quiz #3
	Resource Considerations	
8	Cost Planning and Performance	Assignment #4
	Computer Lab Session – Resources	Computer - Resources
9	Cost Planning and Performance	Quiz #4
	Schedule Control	
10	Schedule Control	Assignment #5
	Computer Lab Session (Costs)	Computer – Costs
11	The Project Manager	
	The Project Manager /The Project Team	Quiz #5
12	The Project Team	
	Types of Organizations Project Communication & Documentation	
13	Project Termination	Quiz #6
	Project Presentations	PROJECT & PRESENTATIONS DUE
14	Project Presentations	PROJECT & PRESENTATIONS DUE
15	Exam Time: Note: Time will be used for additional presentations.	PROJECT & PRESENTATIONS DUE

EVALUATING THE PROJECT

Over ten offerings - six undergraduate and four graduate, 78 undergraduate and 95 graduate students completed this project. Following project completion, students were anonymously surveyed for their input. Specific to the project, students were asked: (1) "Did you learn to apply project management concepts by completing the project?", and (2) "Any suggestions to improve the project?" As shown in Table 1, over 91% of 173 students indicate the positive value to learning project management through this project. At the undergraduate level, 75 students completed the survey, which did not include 3 students who completed the project but were absent from class during the survey. Students' responses were extremely positive and favored the learning technique. 98.68% (75) of the undergraduates indicated that the project was worthwhile, with just one (1.32%) student undecided over its merits. Graduate responses were positive, although not as overwhelming. Specifically 86 students responded to the survey, with 9 students not completing it. Out of the 86 students, 84.88% (73) favored the project, 11.63% (10) were undecided and 3.49% (3) did not favor it. Obviously, the graduate results were less favorable then the undergraduates. Potential reasons include the need to complete the graduate project in groups, the additional complexity of planning two simultaneous projects, or the need to use a common resource base.

Table 1: Did you learn to apply project management concepts by completing the project?

Semester, Year	# Students in Course	Yes	No	Undecided
Undergraduate:				
Spring 1996	5	5	0	0
Fall 2000	10	9	0	1
Fall 2001	5	5	0	0
Fall 2004	17	15	0	0
Spring 2007	16	16	0	0
Spring 2010	25	25	0	0
Undergraduate Total	78	**75 (98.68%)**	**0 (0.0%)**	**1 (1.32%)**
Graduate:				
Spring 1995	28	17	2	4
Summer 1998	22	22	0	0
Fall 1999	23	19	0	4
Fall 2002	22	15	1	2
Graduate Total	95	**73 (84.88%)**	**3 (3.49%)**	**10 (11.63%)**
TOTAL	173	**148 (91.35%)**	**3 (1.85%)**	**11 (6.79%)**

Few students made comments to the open question regarding "any suggestions for improvements to the project". Over the ten offerings, several positive comments include "useful in putting a different perspective on the academic material", "It incorporated all the items learned during the course, and I was able to learn from it", and "A final isn't needed since the project ties together everything!" These comments are extremely favorable responses to integration of project management material, and students note the true purpose to the project. Only a few negative comments on the project were received. The students specifically noted information systems issues with the comment, " We spent hours typing to resolve conflicts and then waiting for leveling to finish. Don't promote this for use on a slow machine!" They also noted how much work is required through the statement, " Keep stressing fact of not waiting or procrastinating on the project!" Other comments in early course offerings included a need to improve the clarity of the questions and development of specific lab activities to assist in project development. Subsequent course offerings modified wording and added the lab activities with the result that these complaints have not been heard since.

Since student solicited feedback on potential improvements was minimal, student surveys in the fall of 2001 included the additional question "Did the project help you to understand the following: work breakdown structure, resource allocation, budget constraints, and project plan development?". Student responses to this question are extremely positive to the project assisting in demonstrating each of these areas. As shown in Table 2, undergraduates strongly indicated that the project assisted in their understanding of the work breakdown structure (100%), resource allocation (100%), budget constraints (100%) and project plan development (97.22%). (Only one student was undecided on the relationship for project plan development.) As shown in Table 3, graduate students also favored the project in furthering their understanding of work breakdown structure (81.25%), resource allocation (81.25%), budget constraints (87.5%), and project plan development (87.5%). Graduates were also asked about the relationship between the project and difficulties in handling competing resources and simultaneous projects. Again, their responses were favorable for both difficulties in handling competing resources (87.5%) and simultaneous projects (87.5%). Perhaps graduate results demonstrate student uneasiness with group work, simultaneous project integration and/or complexities of using a common resource pool in comparison to their undergraduate counterparts.

Table 2: Did the project help you understand the following (Fall 2001-Spring 2007): Undergraduates

Topic	Yes	No	Undecided
Work Breakdown Structure	36 (100%)	0 (0%)	0 (0%)
Resource Allocation	36 (100%)	0 (0%)	0 (0%)
Budget Constraints	36 (100%)	0 (0%)	0 (0%)
Project Plan Development	35 (97.22%)	0 (0%)	1 (2.78%)

Table 3: Did the project help you understand the following (Fall 2001 on): Graduates

Topic	Yes	No	Undecided
Work Breakdown Structure	13 (81.25%)	0 (0%)	3 (18.75%)
Resource Allocation	13 (81.25%)	2 (12.5%)	1 (6.25%)
Budget Constraints	14 (87.5%)	1 (6.25%)	1 (6.25%)
Project Plan Development	14 (87.5%)	1 (6.25%)	1 (6.25%)
Difficulties in Handling Competing Resources	14 (87.5%)	1 (6.25%)	1 (6.25)
Simultaneous Projects	14 (87.5%)	1 (6.25%)	1 (6.25%)

PROJECT MERITS

The general advantages of the project as a learning tool are numerous. As noted in the opening comments, project management is a growing, global arena. The project outlined here can be tailored to the needs of programs around the world. The project encourages application-based, active learning [Volkema, 2010], can be used at both the graduate and undergraduate levels, can be modified to fit a specific course, can include team-based or individual learning, and develops student professional writing and oral skills. The project meets the criteria for project-based learning [Helle et al., 2006] as it requires students to manage their time to complete the project while learning time-management skills, develops a planning document and oral presentation skills. The project also meets the criteria from professionals [Tynjala et al., 2009] that students should know how to plan the whole project, and develop costs and resources. Since students self-select projects, theoretically their commitment to active learning increases [Volkema, 2010]. Classroom discussions are animated and lively as students contemplate the relevance of the issues to their projects. At the graduate level, this project is particularly unique in the development of two simultaneous projects using a common resource base, which is a particularly difficult area to manage. The student also develops professional writing and oral presentation skills. It should also be noted that students seem to generally enjoy listening to their peers' presentations and typically ask relevant, thought-provoking questions regarding the project plans. The instructor gains personal knowledge from reading the reports as to class strengths and weaknesses particularly when a common issue is detected.

This project is a valuable project to the course and program objectives. The specific relationship of the course and this project to the major learning goals and objectives cannot be assessed as the results are confounded with other courses contributing to the major. However, the course specifically reviews the management science techniques of critical path method and project evaluation and review technique, and leadership theories, motivation and organizational structures pertinent to project management. Thus, the course contributes to the specific major learning goals and objectives. (Note, we cannot reveal the specific assessment results at this time, but the reader should note that the results are extremely positive.)

As with any instructional technique there are disadvantages or drawbacks to utilizing this project. Obviously, the undergraduate project lacks developing the team skills noted with other instructional project management projects. Although long-term learning through experienced-based projects is implied, it has not been verified. Student comments indicate that students would like specific demonstration projects to be on-hand for their review. This demonstration project may encourage students to merely copy the demonstration, decrease creativity, and defeat the critical thinking aspects of the project. Also, since many web-sites have actually created projects, there is the potential for students to merely copy the *Microsoft Project* portion of the project. Also, with the graduate projects, several disadvantages in teamwork exist, such as one individual completing the entire project, or difficulties in actually "leveling" the projects. Large class sizes (50 or more) might prove to be difficult to integrate lab experiences into the course and project. Another disadvantage is the trade-off between lab and classroom discussion time. Due to the uniqueness of each project, one of the biggest issues is the inability of students to understand precisely what issues they should be including in the final report. For example, project justification is different depending upon the specific projects involved. In other cases, students struggle with the particular *Microsoft Project* reports to include in their final report. Students are uneasy with the lack of a template. As with any subjectively graded material, personal instructor biases may exist. To overcome this difficulty, grading sheets resembling the actual project (Figures 1) are used for each report and presentation. These sheets also assist students in understanding exactly where credit will be allocated.

Recently developed service-learning projects are valuable team techniques [Larson & Drexler, 2010; Dixon, 2011]. However, as noted by the instructors, project management theory and application are constrained by the semester time frame, and many valuable project management skills are not developed through the service project. Specifically, financial and risk analysis, project selection, detailed project planning, and information system capabilities may not be addressed due to the time constraints. For example, the fund raising project is entrepreneurial in nature and avoids cost analysis or may require additional funding from the instructor or students [Larson & Drexler, 2010]. The engineering service course highlights developing soft-sided skills for technical people who typically do not have additional instruction in the areas of team-building, leadership or organizational development [Dixon, 2011]. In the situation described here, the students are business students that take a variety of courses in the softer skill areas and fewer in the more technical areas. Hence, for the audience described here, this project develops the areas that this population tends to be weaker in, that is, the more technical planning arena. In choosing course instructional methods, instructors need to consider the audience. The project described here has a proven-track record in developing the technical, professional presentation and oral skills.

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Assessing Student and Instructor Satisfaction Using an Audience Response System in Introductory Business Courses

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ABSTRACT

Instructors at all levels of education are constantly searching for ways to keep their students engaged in a course. The authors of this study survey their introductory business students regarding the use of an audience response device (i.e., "clicker") during classroom lectures to ascertain whether the students find the use of these devices to be worthwhile. The overwhelming majority of students report that their use of the clicker enhanced their classroom participation and that they enjoyed using the apparatus. The authors also provide their own perceptions on the clickers, in addition to describing the latest classroom remote technology, the use of iPhones, Androids, and other similar devices as classroom response gadgets.

Keywords: audience response system, i>clicker, clicker, student engagement

INTRODUCTION

Student engagement is a much discussed and researched concept. A recent search using "student engagement" as keywords in Google Scholar produced over 32,000 results. The motivation behind enhancing student engagement stems from the appealing notion that a more engaged student is less apt to be bored, and thus more likely to be focused on material covered in class.

Made famous by the popular television show, *Who Wants to be a Millionaire?*, audience response keyboards, or "clickers", as they are often referred to in the academic literature, have become popular as a way to generate student engagement in university classrooms. The use of clickers appears to be especially prevalent in large science and physics classrooms, if the plethora of studies on clicker deployment in those fields serves as a reliable indicator.

In this paper, we explore the use of clickers in two courses in which business students make up a substantial portion of the population. Specifically, we examine whether students and their instructors are sufficiently satisfied with clickers such that the students' expense and the instructor's time are both deemed to be wisely spent.

BACKGROUND

Instructors at all levels of education have used a vast array of resources to keep students engaged in a classroom lecture or other activities. The problem of "disengaged" students would seem to be even more problematic as classes become larger and larger. However, the previous research suggests that clickers, if used appropriately, can remedy much of the disdain students have for large lecture-style classrooms.

Beatty et al. (2006) find that both students and instructors are generally positive if not enthusiastic about the use of clickers to improve student learning. Fies and Marshall (2006), Caldwell (2007) and Kenwright (2009) provide many good suggestions on how to implement clickers in various aspects of pedagogy, while also nicely summarizing the past clicker literature. Duncan (2006) claims that clickers "address two of the oldest and most fundamental challenges in teaching: how to engage students and how to determine if they are learning what you are teaching." Wood (2004) states that the "give-and-take atmosphere encouraged by use of clickers in our experience makes the students more responsive in general, so that questions posed to the class as a whole during lecture are much more likely to elicit responses and discussion."

Wood (2004) aptly discusses the primary advantages, as he sees them, of using clickers. For the students, the advantages include: 1) the ability to remain anonymous, 2) those answering incorrectly now realize that they are not the only ones to not "get it,", 3) those answering incorrectly often find that it was not their lack of knowledge, but an instructor's unclear or ambiguous question causing the "mistake", and 4) the students become actively engaged in

the material, rather than being passive listeners. The advantages to the instructor are: 1) she or he can use the responses to both evaluate attendance and to possibly provide incentives (i.e., points) for participating in the clicker questions and/or for submitting a correct answer, and 2) he or she now knows immediately what portion of the class did not "get it," rather than having to wait until the next exam results are in…and the instructor can address these knowledge gaps immediately.

There are several options for those instructors wishing to adopt some sort of classroom polling system. Barber and Njus (2007) explore the advantages and disadvantages of six different clicker systems (eInstruction's Classroom Performance System, Qwizdom, TurningPoint, Interwrite PRS, i>clicker, and H-ITT). Barber and Njus encourage universities to standardize or at least limit the number of systems in use by any particular university, in part to lower the cost for students and to hasten the faculty's learning curve.

Though these classroom polling devices have been around for over a decade, there is a paucity of research on clicker use in either the Accounting or Business Law classroom. In fact, there are very few studies of the use of classroom response systems that are based on business students as subjects. A notable exception is Premuroso et al. (2010), who find that the use of clickers in an introductory financial accounting course significantly enhanced student exam scores. Premuroso also finds, consistent with nearly all the previous literature, that students enjoy using an Audience Response System (i.e., clicker). Other examples of studies in which business students are at least part of the subject pool include Grimm et al.(2007), Teeter et al. (2007), McGill (2008), Stagg and Lane (2010), and Morse et al. (2010).

USE OF THE I>CLICKER™ IN OUR COURSES

Simpson and Oliver (2007) describe in great detail the typical ways in which clickers have been used in the classroom setting. Rather than repeat the many alternative methods for using a clicker, we will focus our discussion on the techniques utilized by the two authors of this paper. Both of us imbed questions that are designed specifically to be answered using a clicker (both instructors employ the i>clicker and web>clicker™ systems) in our lectures. Each class meeting consists of anywhere from 2-6 questions to be answered using the i>clicker device. Consistent with the motivation detailed in Cutts et al. (2004), both instructors award points for simply answering the question(s), as well as incentive points for answering a question correctly. Though the device could also be used for such things as assessing students' understanding of outside class readings or other assignments, the authors choose to use the i>clicker almost exclusively to motivate students to keep up with (and understand) material presented in the classroom.

The i>clicker is a radio frequency device, as opposed to many of the early clickers which operated on an infrared signal. As such, the i>clicker does not require a direct sight line with the receiver base. In fact, the newly developed web>clicker system will also recognize answers submitted through many types of mobile devices (iPad, iPhone, many androids, etc..) using a internet-based capture system that then communicates with the same base unit used to collect i>clicker answers in the classroom.

SURVEY INSTRUMENT

To assess whether our use of the i>clicker was keeping students engaged and whether other secondary objectives were being met, a brief survey was administered to students very near the end of each semester in which the i>clickers were employed. The survey also includes a question designed to assist the two authors in their decision as to whether the i>clicker should be used in future courses. The questions:

1) **Did you ENJOY using i>clicker this semester?**
    a. **Strongly agree**
    b. **Agree**
    c. **Disagree**
    d. **Strongly agree**

2) **Did you find using i>clicker this semester to be USEFUL?**
   a. **Strongly agree**
   b. **Agree**
   c. **Disagree**
   d. **Strongly agree**

3) **Did you find using i>clicker this semester improved your participation?**
   a. **Strongly agree**
   b. **Agree**
   c. **Disagree**
   d. **Strongly agree**

4) **Would you recommend that I continue to use i>clicker in future semesters?**
   a. **Strongly agree**
   b. **Agree**
   c. **Disagree**
   d. **Strongly agree**

RESULTS

Table 1 below is an aggregation of all the individual class section results found in Appendix 1.

Table 1: Results of Survey

Grand Totals All Classes	**S. Agree**	**Agree**	**Disagree**	**S. Disagree**	**Total Students**	Strongly Agree + Agree %
Did you Enjoy using i>clicker?	**118**	**86**	**9**	**2**	**215**	
	54.88%	**40.00%**	**4.19%**	**0.93%**		**94.88%**
Did you find i>clicker useful?	**102**	**101**	**11**	**1**	**215**	
	47.44%	**46.98%**	**5.12%**	**0.47%**		**94.42%**
Did find - participation enhanced?	**130**	**70**	**11**	**5**	**216**	
	60.19%	**32.41%**	**5.09%**	**2.31%**		**92.59%**
Would you recommend - future?	**135**	**73**	**4**	**2**	**214**	
	63.08%	**34.11%**	**1.87%**	**0.93%**		**97.20%**
			Total Responses =		**860**	

As Table 1 indicates, students overwhelmingly (~95%) enjoyed using the i>clicker, as measured by the students either strongly agreeing or agreeing with the first question. The students also found the i>clicker to be useful (~94.5%) and that it enhanced their participation in the classroom (~92.5%). Most importantly, however, 208 of 214 students (~97%) responding to the fourth question indicate that they would recommend continuing the use of the i>clicker in spite of its cost. These results did not differ substantially whether the survey was administered to an introductory Business Law course, an introductory Financial Accounting course, or an Intermediate Accounting course (see Appendix 1 for the course-specific results). It appears that a very strong majority of the students, whether early in their business course sequence or in the midst of it, find using a device of this nature enjoyable, useful, and beneficial for enhancing their participation in the courses.

Knight and Wood (2005) also found that the use of a clicker device and other interactive techniques do not harm exam scores, and likely improves them. The results pertaining to whether exam scores have improved post-i>clicker adoption is difficult to address for these two instructors. Exam scores for one instructor has improved substantially from previous semesters. However, the initial use of the i>clicker also contemporaneously corresponded to the initial use of an online homework manager, thus masking the individual effect of the use of the i>clicker system. The other instructor employs enough variation in semester-to-semester examinations such that comparisons become difficult.

INSTRUCTORS' PERCEPTIONS

Both instructors have noted an obvious increase in the participation in their courses. The students thoroughly enjoy getting immediate feedback on whether the recently covered material has been understood. They also enjoy seeing how the class as a whole answered questions, and whether their own answered were consistent with those of their class colleagues. The instructors, meanwhile, receive some extremely valuable (instantaneous) feedback on whether their lectures, outside class readings, etc. have been effective in communicating a concept or topic. Both of the instructors in this study have revised the delivery of certain topics after i>clicker questions have made it clear that previous methods were either ineffective or inefficient in conveying those topics. Simply stated, the i>clicker devices have made the classroom experience much more enjoyable for *both* the instructors and their students in these business law and accounting courses.

DISADVANTAGES OF I>CLICKER

The i>clicker device currently has one major disadvantage when compared to some other clicker systems (e.g., the Classroom Performance System). It is incapable of allowing students "asynchronous" quiz or exam taking. In other words, the i>clicker setup currently dictates that each student is gaining (and losing) access to a question at the same time his or her colleagues are seeing that identical question.

There is also the possibility that a student in attendance may bring multiple i>clickers to the classroom. Jackson and Trees (2003) reported survey results indicating that between 20 and 58 percent of students saw a fellow student use multiple clickers at some time during the semester. The use of multiple clickers would be of greater concern in large classrooms, where an audit of the headcount compared to "employed clickers" on any given day would be problematic.

From the students' perspective, the obvious disadvantage to the use of a clicker is its cost ($30-$40 for the i>clicker, depending on the retailer). However, students report that there are other disadvantages when a device of this nature is used: the possibility of losing the device, using up class time, attaching points as incentive to attend class, and technical problems that may arise (see Halloran, 1995 and Knight and Wood, 2005), and the perception that the clicker questions were driving the lecture material rather than the lecture content helping to produce the questions (Simpson and Oliver, 2007).

WEB>CLICKER™…A NEW TOOL

The cost disadvantage of the i>clicker can be mitigated somewhat through the use of the newly minted "web>clicker" software. Students with a laptop computer or a cell phone and wifi access, or students with certain designated (non-Blackberry) cell phones, can purchase access for the semester or for the year and then log in to the i>clicker home page, select their course and instructor, and submit answers via the web. This saves the students the cost of buying an i>clicker hand unit, not to mention that a student is much less likely to forget his or her laptop or cell phone. Currently available for $10 per semester and $16 per year, the web>clicker registration allows students who bring an internet-capable phone to class the ability to submit their vote via the web. The displayed results in-classroom then incorporate both the i>clicker and web>clicker aggregate votes.

The only negative with this new software is that there is a slight delay in displaying the results when any of the students are using the web>clicker option, though the delay is minimal (4-6 seconds). If the instructor spends a few seconds discussing the alternative answers for the question before showing the display of answers, the students are likely to be unaware of the delay.

CONCLUSION

How many resources available for classroom use—and especially a resource that is not free to students—would have 95 percent or more of those students saying that they enjoyed the use of that resource, they found it useful, and that they would suggest using said resource again in future semesters? The results—particularly the fact that 93.79 percent of students surveyed reported that the i>clicker enhanced their participation in class—illustrate that there is such a tool available. In an era in which instructors are encouraged to do everything in their power to enhance student engagement in the classroom, the i>clicker (or a similar device) appears to assist in meeting that objective.

The use of interaction methods to assist in keeping students engaged in course materials is not new. However, the i>clicker and devices like it provide students the opportunity to provide an anonymous response during the lecture (see Freeman et al., 2006 for the benefits of this anonymity). In especially large classes, this anonymity removes the anxiety many students feel when providing any verbal feedback. These devices also have the enormous advantage of also providing the instructor with an instantaneous assessment of where the students' knowledge level currently stands, as well as supplying a record of attendance without the time it would take to do a roll call or check a seating chart. Note also that Trees and Jackson (2007), seeing anonymity in the large classrooms as potential for students to "hide," advocate the use of clickers to *remove* this anonymity. They also state that, "As an educational tool, clickers do not simply augment the classroom, they *transform* it because of the new responsibilities given to students to guide and affect classroom dynamics" (p. 38).

From a teaching perspective, the instructors have found the i>clicker provides them valuable information about what they assumed to be nearly full knowledge assimilation during their lectures. The i>clicker answers provided by the students can offer instructors substantial insight into what teaching methods provide the students the greatest learning impact and to modify future teaching methods accordingly. It is also worth noting that both instructors observed an increase in their student evaluation numbers once the voting devices were incorporated into the classroom.

There is the obvious danger that the student satisfaction levels reported here are due to the authors' pedagogical approaches to using the i>clicker remotes, rather than the use of the remotes themselves. However, it should be noted that the authors' use of the i>clicker system was both simple and straightforward; using the devices to acquire student responses that normally would have been (ineffectively) accumulated either using a verbal response or a show of hands.

The authors of this study have noted that their students are more alert and more likely to ask questions about the material corresponding to i>clicker questions than they were in previous years. Given that each of the two authors has over 25 years of university teaching experience, the reference points are numerous and the current findings greatly welcomed!

APPENDIX 1

Grand Totals ACTG 211	S. Agree	Agree	Disagree	S. Disagree		
Did you Enjoy	**71**	**40**	**3**	**1**	**115**	Total Students
	61.74%	34.78%	2.61%	0.87%		
Did you find - useful	**49**	**57**	**9**	**0**	**115**	
	42.61%	49.57%	7.83%	0.00%		
Did you find - participation	**75**	**34**	**4**	**3**	**116**	
	64.66%	29.31%	3.45%	2.59%		
Would you recommend	**78**	**34**	**2**	**0**	**114**	
	68.42%	29.82%	1.75%	0.00%	**460**	Total Responses

Grand Totals BLAW 203	S. Agree	Agree	Disagree	S. Disagree		
Did you Enjoy	**43**	**41**	**5**	**1**	**90**	Total Students
	47.78%	45.56%	5.56%	1.11%		
Did you find - useful	**49**	**39**	**1**	**1**	**90**	
	54.44%	43.33%	1.11%	1.11%		
Did you find - participation	**50**	**32**	**6**	**2**	**90**	
	55.56%	35.56%	6.67%	2.22%		
Would you recommend	**53**	**33**	**2**	**2**	**90**	
	58.89%	36.67%	2.22%	2.22%	**360**	Total Responses

Grand Totals ACTG 314	S. Agree	Agree	Disagree	S. Disagree		
Did you Enjoy	**4**	**5**	**1**	**0**	**10**	Total Students
	40.00%	50.00%	10.00%	0.00%		
Did you find - useful	**4**	**5**	**1**	**0**	**10**	
	40.00%	50.00%	10.00%	0.00%		
Did you find - participation	**5**	**4**	**1**	**0**	**10**	
	50.00%	40.00%	10.00%	0.00%		
Would you recommend	**4**	**6**	**0**	**0**	**10**	
	40.00%	60.00%	0.00%	0.00%	**40**	Total Responses

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Thespian Exercise:
An Innovative Approach to Teaching Negotiation Using Interactive Drama

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ABSTRACT

This paper describes an innovative assessable task based on interactive drama called the "Thespian Exercise" that has been used successfully in negotiation courses to improve the learning outcomes of MBA and Executive MBA students. The purpose of the exercise is to test students' ability to practically apply the theories of negotiation to an actual real world negotiation example. Working in small groups, students write their own role play and act it out in front of the other students. Students must also then analyze what occurred during the negotiation using relevant theories and concepts, and synthesize the key learning outcomes based on their experience and reading. Feedback from students suggests they see the value of using an alternative assessment mechanism in a skills-based course and have found the experience to be both a positive learning experience, as well as enjoyable.

Keywords: negotiation, drama, assessment mechanism

"All the world's a stage
And all the men and women merely players
They have their exits and their entrances
And one man in his time plays many parts…"
(Shakespeare, *As You Like It*, Act II, Scene VII)

INTRODUCTION

Negotiation and conflict resolution skills are highly sought after in the workplace. These skills are essential to the employability of students (Carnevale, Gainer, & Meltzer, 1990; O'Neil, Allred, & Baker, 1997) and to managerial effectiveness in general (Lax & Sebenius, 1986). Recent trends requiring managers to increasingly coordinate lateral relationships, such as greater diversity, globalization, networked organizations, and the prevalence of work teams, has further highlighted the importance of negotiation skills for managers (Fortgang, 2000). However, business educators have faced intense criticism for failing to impart useful skills, such as negotiation, in their graduates (Bennis & O'Toole, 2005).

The learning outcomes of negotiation courses centre on the development of the knowledge and skills of students so that they can become more effective negotiators. However, O'Neil et al. (1997, p. 24) has observed that "the development of methods to assess the necessary skills that have been identified and, further, the teaching of such skills, that is, their integration in some manner into the [educational] curriculum" requires attention. Assessment mechanisms used within graduate business courses (e.g. written assignments) are commonly directed at assessing knowledge acquisition (Michlitsch & Sidle, 2002), rather than skill development. As such, alternative assessment tools (e.g. self-reflective learning journals, simulations) need to be developed and utilized commensurate with the focus of such courses. This paper describes an innovative assessable task based on interactive drama called the "Thespian Exercise" that has been used successfully in negotiation courses to improve the learning outcomes of MBA and Executive MBA students.

INTERACTIVE DRAMA

Drama has been used as a training tool in areas such as leadership development because it is an effective way to engage participants in learning activities and to bring actual work scenarios into the classroom (Bentley, 2006; Steed, 2005). Typically, a small number of professional actors are hired to act out a situation and then participants are asked to comment on what they have just witnessed and to make suggestions for improvement. In business education courses, an alternative approach to using actors is to have students work in small groups and actually write the script and then act out the scenario. By requiring students to base their role plays on a real world example both the contextual and practical aspects of the negotiation can also be incorporated into this approach. This kind of

interactive drama can realize valuable learning outcomes because writing the script and acting out the scenario can involve the cognitive, affective and psychomotor learning domains of students (Bloom, 1956).

Writing the script

The cognitive domain is involved in interactive drama because students must understand the subject matter in order to write the script and analyze the scenario using negotiation theories and frameworks. This requires knowledge around essential topics of negotiation including value claiming and value creation processes (Lewicki, Saunders, & Barry, 2006; Thompson, 2005). Engaging students in the role play can also help students to develop their higher order thinking skills (Page & Mukherjee, 2007) including application, analysis, synthesis and evaluation (Bloom, 1956). Application of knowledge of negotiation is involved to solve a specific organizational problem, answer a question or illustrate a negotiation theory. By breaking down the problem into the underlying causes of behavior in the negotiation students develop their analytical skills. Synthesis is also required of students to identify the key learning outcomes from the scenario and integrate the findings with their experience and the literature on negotiation. Finally, evaluation of the effectiveness of the strategy that was used in the negotiation and suggestions for how it could be improved can also develop students' critical thinking skills.

Getting students to write the script, or scenario provides opportunities for deep learning where they can take concepts they 'already know' from other contexts, make connections between concepts and particularly think about variation. Teaching negotiation has a fair degree of what might be called optimistic rationality. For example, if you begin to talk about underlying interests so will the other negotiator, and then a solution of mutual benefit will be found. But what if negotiation is not only two sided but also messy (Fells, 2010), and so the predicted beneficial outcomes of recommended behavioral strategies may not always be forthcoming. Having to write a script forces students to consider the 'what ifs'. For example, if constructing a scenario to demonstrate the power of the Best Alternative To a Negotiated Agreement (BATNA), what if the BATNA in the context has a little less 'weight', what difference would this make to how the negotiators react?

If actors are going to act, then they need a script to work with and developing that script provides another opportunity for students to increase their practical understanding of the nature of negotiation. Asking students to write rather than just enact a negotiation (or part thereof) provides additional opportunities and challenges for learning. Druckman and Ebner (2008) found that getting students to write a negotiation scenario that focused on specified negotiation concepts enhanced the student's understanding of them and more generally strengthened the students' engagement with the learning process. The enhanced cognitive understanding came from having to operationalize the negotiation concepts. Rather than learn about the BATNA and be given examples, students can construct a situation where an alternative to negotiating is a plausible option, thus understanding more about how BATNAs shape one's perceptions and decision making.

Analogical learning, being able to extract commonalities in the underlying structure of differing negotiation situations (Gillespie, Thompson, Loewenstein, & Gentner, 1999; Loewenstein & Thompson, 2000), can also be incorporated into interactive drama exercises by having students consider how their learning applies to other contexts. Being able to assess the structural dimensions of a negotiation is a key aspect of improving skill levels in students (Lewicki et al., 2006). The process of comparing contexts helps students to learn the underlying principles in the examples and to be able to apply those same principles to new situations.

Acting out the drama

The use of role plays as experiential learning opportunities (e.g. Bestbooks and Alpha-Beta exercises in Lewicki, Barry & Saunders, 2007) is not new in negotiation courses. Interactive drama however, allows emotions, attitudes and values to be easily incorporated, encouraging learning in the affective domain (Bloom, 1956). This can provide an opportunity for students to practice dealing with difficult emotions, such as anger, that have the potential to escalate tensions between the parties. Expert negotiators tend to talk more about their feelings than average negotiators (Rackman & Carlisle, 1978). It can also provide students with the opportunity to question their values in relation to negotiation including the ethics of particular bargaining tactics, such as the use of deception.

Nadler, Thompson and Van Boven (2003) found that negotiation performance improved when experiential learning was supplemented with observational learning. Derived from social learning theory, observational learning or modeling is based on the premise that negotiators can improve their skills by observing the skills of others and then practicing those behaviors (Bandura, 1986). Modeling is also valuable in a negotiation course because it can help to

enhance the observer's self-efficacy or self-confidence. Interactive dramas give students the opportunity to observe the skills of others and also to practice particular behaviors while acting out the scenario. Observational learning is considered more effective at changing behavior than lecturing and information disclosure (Movius, 2008).

Interactive drama has the potential to help improve students' learning because it incorporates the psychomotor aspect of learning (Bloom, 1956). By acting out scenarios students can physically and mentally experience the role, facilitating learning and the encoding and memory storage of new behaviors and cognitive schemas. Students are also able to explore different behaviors in a safe environment, encouraging experimentation.

Acting also provides an opportunity for interaction with differing negotiation styles and to experience the strengths and weaknesses of those styles. Gaining insight into their own negotiation style and that of others can improve students' confidence and skill levels (Shell, 2001). Tools to assess students' conflict resolution styles (e.g. Thomas-Kilmann Conflict Mode Instrument) are often therefore, an integral component of negotiation courses. Self-efficacy, or the belief that you can successfully perform the behavior (Bandura, 1977), is critical because it can affect both the tactics that negotiators use and the outcomes they achieve (Sullivan, O'Connor, & Burris, 2006). In a safe environment interactive drama can promote skill development and increased student self-efficacy through psychomotor learning. McAdoo and Manwaring (2009) stress that instructors can maximize long-term learning by setting performance-based goals that emphasize what students *should be able to do*.

THE THESPIAN EXERCISE

The Thespian Exercise has been used successfully in a Western MBA and Executive MBA course since 2002 as a means to meet the learning outcomes. Its aim is to develop the knowledge, analytical and negotiation skills of the students. By developing their own scripts and analyzing how the negotiation frameworks and theories are relevant students must immerse themselves in deep learning of the subject matter. Requiring students to then act out the scenario provides students with an opportunity to experience different styles of negotiating and to respond in real time. An added benefit of this exercise, which was not foreseen when it was developed was that students bought 'live' negotiations to class. This provided a unique opportunity for the students to explore different options and how that might influence the negotiation outcome. A sample set of instructions that could be included in the unit outline or course briefing notes is shown in Table 1.

Table 1: Sample Instructions for Thespian Exercise

The purpose of this assessment is to assess your ability to apply theories and concepts of negotiation to 'real world' problems. You will learn about the process of negotiation by demonstrating and explaining it to the rest of the class. In groups of four or five you are to develop a negotiation scenario which the Russell Crowes and Cate Blanchetts among you then act out!! The aim will be to realistically demonstrate a particular aspect of negotiation theory and practice. The group presentation will also include a class discussion, with a handout prepared by the group. The scenario you choose should be a reconstruction of a work-related negotiation (or part thereof) that one of the members of your group has been involved in or is aware of. You should consult with the instructor to ensure that your topic and approach is appropriate. You will also be required to conduct a discussion with the rest of the class to explore the chosen aspect of negotiation further and prepare a handout as a learning tool for your fellow students which addresses the underlying theory and research, and the application of it in practice. There is no page limit for the script but the handout should be no more than five pages (1 ½ spaced) excluding the reference list. It is expected that groups will draw on at least 6 relevant academic journal articles in addition to those provided in the course materials. The script and handout should be submitted to the instructor for assessment as part of the thespian exercise. Each group will have a total of 30 minutes for their presentation (i.e. the negotiation scenario and the class discussion). A good plan to work to is around 20 minutes for the presentation and 10 minutes for class discussion.

Students have chosen wide ranging negotiation contexts to analyze including air traffic controllers and the Australian government, a multinational mining company and electrical subcontractors, property developers and the

local municipal government, and agent-producer negotiations in the film industry. Another interesting negotiation presented and discussed in class involved a multi-national LNG producer and an organization representing the traditional owners of the land where the company wanted to build a new processing plant. Students have also drawn on creative ideas incorporating some well know characters into their role-plays such as Homer Simpson and Mr Burns. Films are also a useful resource; one group used extracts from the Godfather film as a lead in to showing how the issues could have been resolved through principled negotiation, rather than through using a 'horse head'. Another group constructed negotiations that might have occurred at the Copenhagen Climate Change Conference; and another used their own group negotiation over what they could do for their project as their actual project.

The topic students choose for the negotiation can be wide ranging. For example, students presented a value claiming example that had less than optimal outcomes, and then explored how an alternative approach to the negotiation might have led to a better outcome for both parties. Other students have focused on one particular value creation technique such as logrolling and differing priorities or the use of contingent contracts. In another example, students played out a negotiation and projected up onto the wall behind the two negotiators 'thought bubbles' of what each negotiator was thinking about as a reaction to what the other was saying. To write such a 'thought' script meant thinking through different possible reactions (i.e. the realisation that negotiators can have different reactions to what we say, not necessarily the one we want them to have) as well as, in this case show that two negotiators can reach a verbal agreement but have different understandings of what they are agreeing to. The important point to remember is that the instructor needs to have a clear learning goal in mind when setting the parameters of the Thespian Exercise, including the topic(s) and contexts students may choose from.

The Thespian exercise has been even less prescriptive in that students make their own choice as to the focus of their role play. In its early forms the exercise was even more 'freewheeling' in that students did not even have to write a negotiation script but could choose other forms of demonstration. For example, students considered the importance of 'coding' language. Negotiation researchers are familiar with the various coding schema that are used to analyze the dynamics of negotiation. The challenge for negotiators is to do this in 'real time'. One group focused on this and their 'role play' was that they had a panel of observers equipped with cards for each statement category and as a short negotiation was acted out in front of them they held up what they thought were appropriate statement category cards. It provided a rich learning opportunity for the class to discuss the practical difficulties of closely monitoring the nature (and intent) of statements being made by a negotiator across the table.

Any attempt to open up the learning process has its risks and even though the instructor may endeavour to monitor the students' projects as they develop them, some push the boundaries too far and learning about negotiation can take second place to creative entertainment. Consequently the student remit has been confined more narrowly to reconstruction of negotiations. (Still humour can remain – and assist in learning – as when in one role play the students came in with lots of rolls of toilet paper and proceeded to trade these (issues, tissues!)).

The audience of their fellow students also has a critical role to play in the learning environment. At the end of the dramatization the audience can explore alternative ways of approaching the situation and probe the presenters to develop a greater depth of understanding of the subject matter. The interactive nature of this aspect of the exercise can be a powerful tool for the audience to challenge the presenters with their questions.

To add interest to the exercise instructors can have students vote on the "Russell Crowe Award" for the best male actor and the "Cate Blanchett Award" for the best female actor at the end of the presentations. Students enjoy this aspect of the exercise and it provides an opportunity for students to demonstrate an alternative skill set than that required in a typical academic environment. The awarding of two trophies in the form of Academy Award statuettes and certificates of participation has also been well received. Possible assessment criteria to grade the exercise are presented in the next section.

ASSESSMENT CRITERIA

Following the presentation and discussion students are required to hand in their written report, including the script or description of the roles for their role play, and their analysis of the negotiation to the instructor. The report is assessed according to the following criteria:

1. Did the scenario and handout relate the central models or frameworks for understanding the negotiation process to the topic?

2. Did the scenario and handout identify and present practical applications in a way in which the audience could learn something useful for their future negotiations?
3. Were the major learning points clearly articulated and presented in a way that was easily understood by the audience?
4. Were the learning points well supported with relevant scholarly and practitioner articles on negotiation?

The breakdown of marks and criteria for assessing each of the aspects of the exercise are presented in Table 2.

Table 2: Suggested Assessment Criteria for Thespian Exercise

Assessment Criteria	Percentage of Grade
1. Negotiation Scenario and Role-Play • Knowledge and understanding of negotiation models and frameworks • Practical application(s) identified • Original ideas beyond class discussions • Key learning points clearly articulated • Consideration given to how learning applies to other negotiation contexts • Effective use of visual aids • Relevant readings to support analysis • Evidence of wide reading beyond course material	70%
2. Class Discussion • Effective use of learning aids • Audience involvement • Answers to questions	20%
3. Presentation of the Report • Logical structure and presentation • Grammar and punctuation • Correct in-text Harvard referencing • Harvard formatted reference list	10%

TEACHING NOTES

It is a good idea to encourage students to discuss their ideas for the role-play with the instructor before deciding on their example. Otherwise, students may choose a too simple scenario to enact and analyze. For example, buying a second hand car may be suitable for an undergraduate negotiation class, but is too simple for an MBA or Executive MBA class. Complex negotiations between an employer and a union often provide sufficient depth at this level.

Students sometimes decide to use a 'live' negotiation as their scenario so that they can use the class time to elicit feedback from other students to help with their planning and strategic approach. In these circumstances there are sometimes issues of confidentiality that concern students. This can be overcome by having students describe the industry and nature of the parties using fictitious names.

It is important to make sure that students are required to supplement their analysis of the situation with appropriate readings otherwise their learning can be surface level. It is also useful to encourage students to use visual aids such as PowerPoint slides to illustrate their learning points. Commonly, students do not clearly present their learning points – perhaps, because they spend too long on writing the script leaving too little time for the analysis.

An important point to emphasize with students during the briefing is that they must synthesize the key learning points from their scenario and role play. Three key learning points seems to be a manageable number that provides sufficient depth and breadth to the analysis. An example of three learning points from a negotiation between a union and employer over a pay dispute were: (1) negotiation is a skill that can be learnt; (2) the 'pie' may be bigger than you think; and (3) as an agent you must understand the limits and walk away points of the party you represent.

Another consideration in the use of this exercise is cultural and gender sensitivity. Students need to be reminded that the usual classroom code of behavior still applies and that they should behave as they would in the workplace.

Some students are not comfortable with acting the role in front of the class. It is best to leave the organization of the project to the students so that they can take on roles they are comfortable with. Surprisingly, students who initially express some apprehension about 'performing' in front of their classmates often end up wholeheartedly enjoying the experience and it is not unknown for them to receive the acclaim of their fellow students for their acting ability.

The Thespian Exercise could also be used as a class exercise without being assessed. An extension to the non-assessed running of this exercise is to use trained actors to portray roles within the students' scenario. The actor could be given a brief description of the situation or the dialogue for their role in the play. Afterwards, the participants can be given feedback from other students involved in the theatre as well as the actor. It would also be useful to employ actual actors to take on one of the roles in the scenario so as to bring an additional real element to the role-play.

CONCLUSION

While role plays are commonly used in negotiation courses, interactive drama also has the potential to be a powerful learning tool. Interactive drama is a more holistic approach to teaching negotiation skills in business education because it incorporates cognitive, affective and psychomotor learning domains. The benefits to students of using interactive drama, such as the Thespian Exercise, include intellectual stimulation, as well as it being emotionally challenging and often contextually and practically relevant to their workplaces. Furthermore, it is difficult to develop appropriate assessment mechanisms in a subject such as negotiation because of the practical nature and applied aspect of the subject. The Thespian Exercise provides instructors with an alternative means of assessment in a skill based unit, such as negotiation. Feedback from students has been that the exercise is both a valuable learning experience as well as being enjoyable. Although this paper has discussed the application of interactive drama using the thespian exercise in negotiation courses, the same approach could also be utilized in other courses in business education such as leadership, teamwork, conflict resolution, communication, or organizational change. In the words of Steed (2005, p. 52) "theatre-based training is, at its core, a compelling modality that *involves* participants and opens the way to understanding."

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Documented Problem Solving as a Learning and Assessment Technique in Operations Management

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ABSTRACT

Documented problem solving is compared to larger-scope consulting or field projects as a formative assessment technique in an introductory undergraduate operations management course. In this four-week assignment, students apply process analysis and improvement concepts and analytical tools to diverse service and production operations, with consistent learning outcomes. Operations are selected on campus as well as in the outside community representing examples of project, job shop, batch, assembly, and continuous processes, so students can observe the wide applicability of course concepts. A collaborative class wiki is used for documenting the students' analysis, allowing instructor feedback and student revision at intermediate review points during the assignment, and providing a rich visual medium for the final team reports and class presentations.

Keywords: operations management education, process analysis, wiki, experiential learning, active learning, documented problem solving

INTRODUCTION

There are numerous challenges when teaching the introductory undergraduate operations management course, particularly in business schools without a concentration or major in operations or management science. Traditional-age undergraduate students with little work experience, and especially without experience in a service or production operations function, may have difficulty seeing the applicability of a toolbox of seemingly unrelated quantitative techniques. Operations management faculty members are challenged to provide a consistent framework for uniting fundamental analytical techniques, and to lead students to apply these across diverse business operations.

In the University of Richmond Robins School of Business, traditional-age juniors and seniors who major or minor in business must take a single operations management course. Except for internships and part-time jobs during the semester or the summer, these students have little work experience and live on campus. In addition, each semester 10-20% of the students in each course section are visiting international exchange students who are studying the American business environment, in a different culture and a different language. Over the past two decades, operations management faculty members in the business school have used a variety of assignments in class including problem sets, simulations, and case studies, generally without experiences outside of the classroom.

In comparison, in the University of Richmond School of Continuing Studies, adult part-time undergraduate students in the Information Systems major take a similar course focused on operations activities as business processes. These students work in various corporate, health care, legal, military, and governmental organizations around the Richmond area. The students in this class have business and IT experience, and deal with operations on a daily basis at the level of a business unit or corporation.

This paper will describe the application of an experiential learning technique that gets operations management students in both schools out of the classroom to examine an operation in more depth. Some student teams choose familiar operations on campus to study underlying processes, like the campus dining hall. Some target organizations are unusual or less familiar to the student, like the steam plant on campus or a family business. Students apply a consistent process analysis methodology at first, then specific techniques used will depend on the nature of the operation and the most important management challenge observed (capacity, quality improvement, lean, etc.). This assignment can be completed in four weeks instead of a whole semester. The faculty member can view intermediate project documentation in a class wiki without excessive time outside of class, and can provide formative feedback to each student team.

LITERATURE REVIEW

In (Ahire, 2001), 70 operations management student field projects were undertaken during the 1998-1999 academic year to help client organizations identify strategies to improve operations performance. The commuter students were more mature than traditional 20-22 year-old college juniors and seniors, and they had work experience. Working in teams of two, the undergraduate students selected their projects, and worked closely with the faculty member throughout the semester to clarify project scope, check detailed data collection plans, and review of draft reports. Client managers evaluated students' work privately at the end of the semester. Ahire noted significant work with the student groups outside of class. Class time was designated for coverage of concepts and operations management analytical techniques, targeted toward the needs of the diverse projects. Many of the projects identified measurable dollar savings for the clients. Students described an increased sense of accomplishment, and the projects presented opportunities for enhanced teaching and research for the faculty member.

Student consulting projects in a required undergraduate management science survey course are detailed in (Grossman, 2002). For this project, multiple faculty members standardized the project assignment across multiple sections. Five hundred students in 1996 were divided into groups of six, and each team selected their own project in the local community. Class time was spent on the modeling process, and Grossman concluded that "a descriptive model is a prerequisite for using a prescriptive OR/MS technique." He found that in reducing the class time devoted to OR/MS tools, they increased students' ability to apply the tools in their projects. The faculty also spent more time on students' communications competencies. In this case, the undergraduates did not have any expectation that they would influence the clients' business performance, and projects often did not have tangible dollar savings beyond motivating clients to look at their processes in a new way. The most important benefits for students were an improved ability to deal with ambiguity, manage real-life data problems, and use judgment and interpretation, leaving the "cookbook" approach behind.

Heriot et al, 2008 described the use of undergraduate student consulting projects working with small business owners for active learning outside the operations management classroom. In order to manage faculty time constraints, they structured the projects differently from those described in previous literature on what they term "traditional" field-based consulting used in entrepreneurship and small business administration courses. First, their operations management course projects were selected by the students, rather than the instructor. Second, students were not closely supervised by the instructor above and beyond periodic communications on progress during the semester. Third, projects were narrowly focused on tactical issues, with the goal of making an immediate impact on the small business organization's performance. Fourth, students made the choice whether to present a 5-6 minute summary of their project versus writing a paper about their project, in comparison to the traditional written analysis and final presentation required for a Small Business Institute® project. While the experiences were not as predictable as simulations or case studies, the authors were satisfied with the diversity of the 44 consulting projects and the effective application of course concepts.

In teaching environments where projects outside of the classroom lasting a full semester and/or requiring a lot of coordination are infeasible due to constraints on faculty time, there are smaller-scope techniques that have been found to be effective. In "Starting Point: Teaching and Learning Economics," faculty at numerous universities discuss active learning innovations. One example, "Documented Problem Solving," was originally described in (Angelo and Cross, 1993) and is applied to economics instruction at http://serc.carleton.edu/econ/dps/index.html. Documented problem solving has the following characteristics:

- Increases student awareness of their problem-solving strategies or process, rather than a focus on getting the "correct answer." Student decides when their current level of understanding is not adequate.
- Promotes the development of critical thinking and problem solving using course concepts.
- Provides a formative assessment in which instructors can view student thought processes, mistakes, misunderstanding of concepts, and opportunities, and facilitate improvements.
- Allows instructors to provide feedback to students.
- Adapts easily to different academic disciplines.

Documented problem solving is seen to be especially helpful when students seem inhibited to ask questions in class, and allows the instructor another way to measure understanding beyond testing.

THE PROCESS ANALYSIS PROJECT

Learning Objectives for the Project:
The Process Analysis Project was a comprehensive project conducted the last month of the semester in Fall 2009 and Fall 2010, after all course concepts and analytical techniques had been covered in class. The project was 20% of the final grade. There were 30-35 projects completed each semester in three course sections. These were presented in class during the extended exam time slot so there would be ample time for each team. Appendix A shows the assignment from Fall 2010. The learning objectives for this project were:

- Integrate functional knowledge from the operations management course
- Apply the concepts and analytical tools of operations management to the analysis of an organization's critical processes
- Review key business literature and data sources for information pertinent to the students' chosen topic
- Recommend potential solutions to a key operations problem
- Communicate analysis and supporting data effectively in a report to organization management

Selection of Project Teams:
In the Robins School of Business operations management course, students worked in teams of two or three (two preferred). They selected their own teammates, and most selected organizations for study from a list provided by the faculty member (these suggested topics had a known scope). Some teams chose other organizations of personal interest, with the instructor's approval. In the Information Systems business processes course, each student worked individually on the project, choosing a department or process spanning multiple departments or organizations, from their own workplace or a family business.

Use of the Collaborative Wiki:
The free Google Sites Wiki was used for preparing project reports. This online platform allowed classmates to work synchronously or asynchronously, and the faculty member could view project progress and each teammate's contribution. To keep the project within the desired timeframe and scope, strict deliverable deadlines were used as checkpoints during the project. The faculty member could provide written feedback directly in the wiki, as well as coaching during class time. The wiki platform allowed the use of images, YouTube video clips of the operation in action, supporting web links to the organization's website and related information, and supporting attached documents such as spreadsheets and operations manuals. The wiki also gave students experience with collaborative groupware. Students could view other teams' projects, and used the wiki for visual aids during the final presentations.

Diversity of Processes Studied:
Students applied course concepts to their workplace, family business, or an on-campus organization. Examples of processes analyzed were (* indicates projects by adult Information Systems majors):

Project Processes
Audit Process at KPMG – Staff Utilizations
Bottleneck Project Tasks – Family-Owned Construction Company

Job Shop Processes
Geno's Steaks in Philadelphia
Healthcare - Effect of Adding Customized Executive Health Services on Over-utilized Resources
Campus Dining Center - Waiting Lines Produce Forecasting Data
Campus Center for the Arts - Patron Arrival Process Improvements
Campus Technology Learning Center - Appointment Scheduling
Campus Retail Operations – Cafes, Coffee Shop, Restaurant
Capacity Utilization at Pacific Coast Tans*
Law Firm Document Management System Performance*

Batch Processes
Central Virginia Foodbank's Community Kitchen - 4000-6000 Daily Meals and Growing

Campus Dining Center - JIT Purchasing Practices More Adaptable Than EOQ
Campus Dining Center - Inventory Management Targets One Percent Waste
Campus Summer Events and Conferences - Effect of Setups on Net Income
Campus Print Shop Workload Characteristics
Annual Report Distribution at VA State Corporation Commission*
Carmax Centralized Title Handling System*
Charge Entry Analysis – Orthopedic Practice*

Assembly/Repetitive Processes
Campus Dining Center - Automated Dishwashing Line Process
Admissions in the School of Continuing Studies – Yields in the Enrollment Management Funnel
Pooling Inventory of Fast-Moving Products for National Grocery Distributor*

Continuous Processes
Campus Steam Plant and Underground Heating System

Additional Management Lessons for Students:
Students observed well-run as well as struggling operations, and were amazed by the size and remarkable award-winning performance characteristics of the campus dining hall. They learned additional insights from interviewing experienced general managers and supervisors of newly-opened enterprises. They observed the integration of campus-wide dining services, the system-wide impact of a change in the university meal plan and its influence on student dining behaviors. They observed the organization culture in each unit and its impact on business processes. They evaluated the availability of data for decision-making, in some cases absent or in inflexible output formats from primitive point-of-sale systems.

While the students did not take on the role of "consultant," they could readily identify critical issues and recommendations for each operation. The process analysis methodology was reliable and provided a consistent language for analysis of extremely diverse processes.

International students (from Italy, Botswana) in some regards showed the most growth. The active learning project was more effective than case studies and homework exercises because these students simply had not observed business processes in their own countries like some extremely common processes in the United States used in class.

View of Student Thought Processes by the Faculty Member:
It was very useful to observe, and influence, student work practices. Significant project work required starting early and adhering to deliverable deadlines, particularly when working in teams. The use of the wiki allowed goal-setting and convenient follow-up by the faculty member on project progress, without having to meet with students as much outside of class.

One very common student misconception became apparent – the definition of "inventory." In job shop processes or project processes the inventory of primary interest is the inventory of customers or jobs or cases in a law firm, etc. Some students tended to focus on the inventory of *supplies* at first, because this was the most visible. This became apparent in the wiki reports, and students were re-directed by the faculty member.

The grading rubric shown in the assignment was developed over the years in other projects. In this project, the rubric led to consistent results from most of the students, subject to individual performance differences.

CONCLUSIONS

The documented problem solving approach, combined with a collaborative technology supporting instructor feedback during a project, allows a faculty member to integrate active learning outside the classroom into the operations management course. Preselected topics help control the scope and variety of the projects. Because the coordination requirements are lower, the projects can be completed efficiently in the scope of the semester. In addition to the dining hall and all eating establishments on campus, the print shop, and the steam plant, we have not yet studied the bookstore (in competition with online used textbook sources) or campus recycling/sustainability

processes. Area non-profits like the Central Virginia Food Bank and Community Kitchen have very accessible operations that also interest students, so this project option may be expanded in the future.

Follow-up with host organizations also needs improvement. Managers can be invited to share the wiki (view only), or come to the final presentations, but this needs to be formalized more in the project expectations. Students confidently provide insights about fundamental process behavior and improvements, which may result in cost savings and increased profitability. These insights need to be communicated consistently to host organizations.

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APPENDIX A
PROCESS ANALYSIS PROJECT ASSIGNMENT

Project Objectives:

- Integrate functional knowledge from the operations management course
- Apply the concepts and analytical tools of operations management to the analysis of an organization's critical processes
- Review key business literature and data sources for information pertinent to the student's chosen topic
- Recommend potential solutions to a key operations problem
- Communicate analysis and supporting data effectively in a report to organization management

Project Deliverables:

1. No Later Than Friday, November 5 – Review Process Idea and Scope with Dr. Walk, Outline in Wiki
2. No Later Than Monday, November 22 – Intermediate "Management Review" with Dr. Walk
3. No Later Than Monday, November 29 – Complete Data Collection, Review with Dr. Walk
4. No Later Than Friday, December 3 – Focused Literature Search with Librarian, Working Bibliography in Wiki
5. No Later Than the Day of Final Exam – Presentation to the class and Final Report in Wiki

Choose a Process:

Choose a process where you are able to analyze flow rates, constraints, capacity, etc. for an operation of interest to you personally. Such a process should be causing performance problems for an organization (business, healthcare, government, or non-profit). Discuss your topic with me, so we can set bounds, and apply the concepts of the course.

Process Analysis – Structure and Data:

Examine key data from your organization— forms, spreadsheets, or database queries of key data available for analyzing the problem(s) with your target process. You may need to collect some data if what you need does not exist. Other sources may include the organization web site, annual report, budget summary. Identify the following in your report:

- **Process Type(s)** – evaluate the operations, and describe what type of process is present (continuous, assembly, batch, job shop/queuing, or some combination in multiple stages). Is it a manufacturing, service, or quasi-manufacturing operation?

- **Flow Unit(s)** – what is flowing through the operations: product inventory? people? time?
- **Flow Rate** – what are some of the flow rate measures for this operation? Are there multiple ways to state flow rates? What is the actual flow rate, the capacity flow rate, the demand flow rate?
- **Flow Time and Cycle Time** – is there a setup time or a lead time before work commences on the flow units? Can setups be reduced or streamlined?
- **Inventory** - what is the inventory in this system? Value of inventory? Inventory turns per year?
- **Process Diagram** - What resources are visited by the flow units? Draw a process diagram identifying each resource. Include buffers and waiting lines.
- **Utilizations** - can you estimate or calculate the utilization of each resource in the process? Average utilization of the overall process? What are the implied utilizations of each resource?
- **Constraints** - Identify the current constraint in the process: is it input-, capacity-, or demand-constrained? If capacity-constrained, what are alternative sources of capacity? If demand-constrained, what are alternative uses of excess capacity to generate revenues or save expenses for the organization?
- **Bottlenecks** – Identify the bottleneck(s) in this operation. How does the organization strive to reduce bottlenecks, and how can it improve?
- **Variability in supply or demand** - how does it impact the flow rate in this organization, and how can the organization improve consistency and quality?
- **Match between supply and demand** -- How closely have supply and demand been matched over the past few months,/quarters,/years, etc? Provide a graph and if possible some high-level summary. Describe demand – does it show seasonal or cyclical variability, or some trend? Is your process an example of a "newsvendor" problem, with obsolescence and only one opportunity to supply before demand is known?

Wiki Report:
Use the following headings and subheadings to organize your report in the class wiki. Each of the following sections will be a page in your wiki. Number the report sections as indicated so they will appear in sorted order in the wiki.

1.0 Executive Summary - In one page maximum, summarize the process studied, define the problem to be solved and the purpose of the analysis, and summarize your recommendations. This is written last.

1.1 Mission - In one or two paragraphs, state the mission of the organization/division studied.

1.2 Description of Operations - Describe the operation's structural features and characteristics determined in your process analysis:

Process Type
Flow Unit(s)
Flow Rate
Flow Time and Cycle Time
Inventory
Process Diagram
Utilizations
Constraints
Bottlenecks
Variability
Match between supply and demand

1.3 Management Issues(s) and Supporting Data - For each question posed by or important to decision-makers in your organization, summarize and present your data analysis in the form of tables and graphs to answer the question. Interpret the findings.

1.4 Recommendations - Describe your major findings in your analysis of operations, and present recommendations for further study or management action.

1.5 Bibliography - Use five or more pertinent references, in APA format.

Other Report Requirements - We will be using a class wiki for collaboration between you and your teammates, and for developmental feedback on intermediate deliverables from the instructor with ideas, suggestions, and questions. You will present your completed project using the wiki, including images, video clips, data, and supporting hyperlinks to other web sites. Because each of you will have editing capability in the wiki, DO NOT alter other teams' sections. Please DO the following:

1. Use business/technical writing techniques effectively. Write for a management audience, clear, detailed yet succinct, easy to scan.

2. M.O.V.E. (Make Your Report Organization Visible Every Time), with headings, subheadings, and bulleted lists as needed.

- Average sentence length should be about 17 words. Split run-on sentences in two.
- Use active voice, not passive voice (subject – action –> predicate; this saves words).
- Each paragraph deals with one idea, and the leading sentence introduces the issue in the paragraph.

3. Proofread to ensure there are no typographical and grammatical errors. Do this as you write, not just at the end. Read your paragraphs ALOUD to catch errors.

4. Single-space your paragraphs, and put a double space between paragraphs.

5. Insert images effectively in the text. Use tables to display data and to control the layout of your report. Video clips may be used. URLs may be used in the text leading to supporting information on the Internet.

6. Insert in-text citations to your bibliographic references as you write, so you keep your sources of information organized.

7. Summary data and graphs must reproduce well in black and white, so choose your colors and patterns accordingly. Use clear titles and axis labels in graphs and tables.

8. Number each graph and table with a figure number, and use this figure number to reference each in the text of your report.

9. Include a bibliography as your last page, in APA format. This is to give credit for ideas where credit is due, and allows your readers to go to original sources for more information.

10. Estimated length of report: 9-10 pages single spaced including data tables, graphs, and bibliography.

11. Know your software tools. Excel is best for calculations and graphs. Database management systems like Access and Banner are best for queries, integrating data across all departments in a firm, and enforcing the integrity of the data. If datasets are provided, examine how your questions were formulated into a database query to retrieve the source data for analysis, and import it into Excel. If you need to collect data yourself, plan your Excel analysis.

12. Save any supporting Excel file(s) and images frequently to the NetFiles server as a backup.

Suggested Literature Search Topics:
These are just some examples of topics you may wish to investigate in your literature search, depending on the issues you observe during your process analysis. In some cases these topics are advanced topics from the latter chapters of our textbook with possible application to your project. You can research specific industries as well. Make an appointment with a librarian for individual assistance.

Scheduling in Healthcare Environments
Lean Six Sigma
Complexity in Products and Services
Using Collaborative Technologies to Improve Processes (e.g., GoogleDocs, Microsoft SharePoint)
Help Desk Service Processes
Call Center Service Processes

Medical Practice Management
Electronic Medical Records Management
Analytics
Reactive Capacity
Delayed Differentiation
Delayed Customization
Risk Pooling
Location Pooling
Inventory Pooling
Product Pooling

Grading Criteria:

- ✔ Explanation of Process Analysis and Issues (35 points)
  - Coverage of required information
  - Demonstrated understanding of the process analysis methodology
  - Management insights learned about your process
- ✔ Communication Skills (30 points)
  - Strong introduction (ask a question, state a fact or quote, give an illustration)
  - Logical development of ideas
  - Clear organization (topical, chronological, problem-solution)
  - Effective use of bullets, active voice, 17-word average sentence length, subheadings
  - Conclusion summarizing main points
  - Reach the appropriate level for the audience; explain technical terms if needed
  - Free from grammar and spelling errors
- ✔ Use of Wiki (15 points)
  - Adherence to deliverable deadlines reporting progress to the instructor through the wiki
  - Use of group pages to collaborate in and out of class, with equitable contributions
  - Consistent use of color and fonts for readability
  - Use of images or video (to add to reader's understanding of process)
  - Use of supporting web links to give the reader additional, related information
  - Adding and moving pages dividing up the finished document for easy reading
  - Effective use of tables to present data
  - Effective use of anchors (links within a page) for organization and easy reading
- ✔ References Used (10 points)
  - Minimum of five high-quality sources
  - Detective work in researching your topic (e.g., interviews with experts, WWW resources)
  - Proper attribution in APA citation format
- ✔ Oral Executive Presentation (10 points)
  - Ten-minute time limit to summarize the most important issues and results
  - Do not read your report
- ✔ Plagiarism (-100 points)
  - Cite all references and quotations properly.
  - Suspicious blocks of text that do not sound like your writing will be checked electronically.

When in doubt, or if you do not understand some of the terminology or literature sources, ask questions (instructor or a librarian).

Processes for Developing Simulation Self-Esteem

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ABSTRACT

In this study we investigate the influence of different methods of learning, perceptions of the decision making process, involvement in various types of decision making, and expected course grade on simulation self-esteem in 98 undergraduate business students as part of their capstone course experience. Results indicate that learning the business simulation from peers and from hands-on experience are related to simulation self-esteem. Furthermore, perceptions of team leader competence and being involved in group, strategic, and financial decision making are all associated with simulation self-esteem. Implications and directions for future research are discussed.

Keywords: Organization-based self-esteem, Business Simulations

INTRODUCTION

In response to the demands of many organizations today, business schools are increasingly concerned about their students' developing marketable skills in leadership, innovation, problem solving, and decision making, as well as providing students with opportunities to apply these skills in real-world applications before they graduate. Undergraduate students often lack the career specific experiences that allow them to feel confident and develop self-esteem concerning their ability to link the course work they've taken to viable solutions in the workplace (Chapman and Sorge, 1999).

Total enterprise business simulations designed to replicate the dynamic, complex business environment are one way to enhance these skills in undergraduate business students. Over 95% of AACSB International member schools use business simulations in their undergraduate and graduate capstone policy courses (Faria, 1998). Participation in business simulation exercises can often stimulate students' motivation and engagement (Aldrich, 2003, 2005), develop intuition and problem solving skills (Anderson and Lawton, 2004), and involve students in the decision making process. They also allow students to transfer coursework knowledge to real business situations and provide opportunities for students to assume leadership roles (Cadotte, 1995; Chapman and Sorge, 1999: Doyle and Brown, 2000). More importantly, students can engage actively in situations where there are consequences for their actions, and as a result, they must re-think their original strategies. This process of receiving feedback, sharing observations and strategies with others, and adjusting behavior and attitudes to help solve business problems not only enhances learning, but can also increase the perceived value that individuals have of themselves as being important and competent (Keys and Wolfe, 1990). In other words, it is a way for students to enhance a form of organization-based self-esteem (OBSE) referred to as *simulation self-esteem* (Mayer, Dale, Fraccastoro and Moss, 2011).

Activities involved in a total enterprise business simulation mimic the tasks that students may face while working in an organization. If educators could only cultivate this type of OBSE in students regarding their simulated organization, they could potentially help students realize the positive outcomes associated with self-esteem. Thus, the focus of this paper is to investigate the influence of different methods of learning, perceptions of the decision making process, involvement in various types of decision making, perceptions of team leader competence, and the expected course grade on simulation self-esteem. In the discussion that follows, we will present a focused review of organization-based self-esteem and develop hypotheses regarding simulation-based self-esteem.

ORGANIZATION-BASED SELF-ESTEEM

In general, self-esteem is defined as the overall self-evaluation individuals make about their competencies and the extent to which they believe they are capable, significant, and worthy (Rosenberg, 1965). Korman (1970) views the high self-esteem individual as having a "sense of personal adequacy and a feeling of having achieved need satisfaction in the past" (Korman, 1966, p. 479). More specifically, organization-based self-esteem (OBSE) is

formed around work and organizational experiences and reflects the perceived value that individuals have of themselves as being important, competent, and capable as an organizational member (Pierce, Gardner, Cummings and Dunham (1989). OBSE has been linked to a number of important work attitudes and behaviors that employers value such as intrinsic motivation (Pierce et al., 1989), work satisfaction (Bowden, 2002; Gardner and Pierce, 1998; Pierce et al., 1989), organizational commitment (Covin, Kolenko, Sightler and Tudor, 1992; Gardner and Pierce, 1998, 2001; Ragins, Cotton, and Miller, 2000), coping with change (Brockner, 1988), and performance (Pierce et al., 1989, Van Dyne and Pierce, 2003). Furthermore, Pierce and Gardner (2004) argue that early in an individual's tenure with an organization OBSE is more malleable or individuals have unstable feelings of self regard. However, as tenure increases, self-esteem evolves into a more stable, inner level self-concept. Thus, the more job experience an individual has, the more they believe they are an important part of the organization and that they truly can make a difference.

Researchers suggest that OBSE emerges from three majors sources: an implicit signal sent by organizational structure/job characteristics (e.g., job design) (Korman, 1971), the social messages sent by meaningful others in the organization that are internalized into the employee's concept of self (e.g., feedback from supervisor) (Brockner, 1988), and feelings of efficacy and competency derived from an individual's own experiences (e.g., successful completion of a task or project) (Brockner, 1988; Korman, 1970, 1976; Bandura, 1997).

Pierce et al. (1989) theorized that any form of system-imposed behavior control, or external control system, carries with it an assumption about the incapability of individuals to self-direct and self-regulate. As individuals experience higher levels of self-expression and personal control, there is an increased likelihood that the person will attribute positive events to themselves, thereby influencing their level of organization-based self-esteem. Conversely, rigid, mechanistic organizational structures often limit autonomy and perceptions of control.

Elloy and Randoph (1997) studied the effect of leader behavior in autonomous work groups on OBSE. They suggest that leaders contribute to OBSE when they permit their followers to exercise self-direction and self-control, and provide the follower with the opportunity to exercise competence and experience success. Similarly, Deci, Nezlek, and Sheinman (1981) and Deci, Schwartz, Sheinman and Ryan (1981) found that in classrooms where the teacher was autonomy oriented, both the intrinsic motivation and the self-esteem of students increased relative to that of the students in classrooms where the teacher was more control-oriented. That is, they tended to lecture and explain more, and they gave students less choice and opportunity for autonomous learning. More recently, Wingfield and Black (2005) found that active course designs resulted in students perceiving learning to be more meaningful to their future jobs. Simulations are a form of active learning, but we found no research that has examined the most effective methods for teaching students how to use the simulation for improved simulation self-esteem. Thus, the following hypothesis is proposed:

H1: A student's perception of how they learned the simulation (i.e., student manual, hands-on, professor's lecture, and/or through peer interaction) will be directly related to the student's perceived simulation self-esteem.

The notion of individuals working in groups is quite prevalent in most organizations today. In fact, it has been suggested by Cohen and Bailey (1997) that as much as 80% of middle to larger-sized organizations rely on various types of teams to give them a competitive advantage in today's rapidly changing, global economy. As a result, it has become imperative that job applicants possess the knowledge and skills that allow them to become a successful team member.

There is also an increasing amount of attention being paid to groups and team development in higher education. Cassidy (2006) notes that teamwork by students is especially useful in developing what is often referred to as the non-technical skills such as problem solving, cooperation, self-management, dealing with conflict and communication. Equally important, researchers suggest that students learn more effectively when they are able to experience learning through active participation in the learning process (Allen and Young, 1997). Participation in decision making applied to business simulations may help group members to perceive that they are important for the success of the group, thereby enhancing their self-esteem. As a result, the following hypothesis is proposed:

H2: When participating in a total enterprise simulation, the student's perception of the decision making process (i.e., group decision making versus autocratic decision making) will be related to the student's perceived simulation self-esteem.

The social messages sent by meaningful others (e.g., a supervisor) in an organization can have a positive or negative impact on a worker's self-beliefs. For example, supervisors who compliment employees on a job well done, are often silent when displeased, and even try to punish those that don't comply. Over time these social cues can shape a worker's attitudes and beliefs. Positive feedback enhances an employee's self-beliefs (Bandura, 1997). Conversely, negative social cues can also decrease a worker's self-esteem. Likewise, it can expected that as a professor provides feedback to a student in the form of grades, the student will develop self-beliefs consistent with the grade achieved (Crocker, Quinn, Karpinski and Chase, 2003). This is especially true if the student values the outcome (e.g., grade). Thus, the following hypothesis is proposed:

H3: A student's expectation of their final course grade will be directly related to the student's perceived simulation self-esteem.

Brockner (1988) and Korman (1970, 1976) along with others have suggested that individuals learn and build self-esteem through incremental successes over time such as successfully completing a difficult project or solving a complex problem. Similarly, it can be expected that the more a student is involved in making decisions regarding their simulated company, the more they develop beliefs of competence based on experiences. In addition to increasing efficacy and self-beliefs, researchers have reported that employee involvement also improves decision-making quality and commitment (e.g., see Kahnweiler and Thompson, 2000; Parker and Price, 1994; Yammarino and Naughton, 1992). That is, several employees working together can potentially generate more and better solutions than the same people working alone. Thus, involvement fosters commitment and the individual is more likely to view what is accomplished as their own and personally take responsibility for the results of their work. Therefore, the following hypothesis is proposed:

H4: A student's perceived level of involvement in financial decisions, strategic decisions, and functional decisions will be directly related to the student's perceived simulation self-esteem.

A leader can be defined as someone who has followers (Dyer, 2008). Choosing to be a follower is voluntary, and team members opt to follow a leader because they trust that person will help the team do well. Competence is a pre-requisite to trust (Sheikh, 2008) and is demonstrated through the actions of the leader (Forgie and DeRosa, 2010; Sheikh, 2008).

Stephen Covey (2006) suggests that an important leadership trait is the ability to demonstrate a level of competence that facilitates high trust. Trusted team leaders are better able to share a compelling vision for success (Dyer, 2008). When leaders effectively communicate a vision and simplify messages, they are more likely to engage followers and build a sense of capability and optimism (Conchie, 2009). Feeling capable is inherent in the definition of self-esteem (Rosenberg, 1965; Pierce, Gardner, Cummings and Dunham (1989). Thus, the following hypothesis is proposed:

H5: A student's perception of team leader competence will be directly related to the student's perceived simulation self-esteem.

METHODS

Sample

A sample of 98 undergraduate business students at a mid-size Southwestern University participated in the study. One hundred questionnaires were administered with a response of 98 usable questionnaires. The sample consisted of 52 percent females and 48 percent males. Over 73 percent of the respondents were 21-24 years of age, 15 percent were 25-30 years of age, and 11.5 percent were 31 and over. Finally, 16.3 percent of the sample indicated that they were Accounting majors, 9.0% Finance, 13.3 % General Business, 17.5% Management, 20.4% Management Information Systems, and 23.5% were Marketing majors.

Procedures

As part of their capstone course, students self-selected teams which competed among each other in the *Business Strategy Game* (Thompson & Stappenbeck, 2002). In the capstone course, students are expected to integrate prior learning from their core business administration classes. The simulation is one tool students use in the course for demonstrating this prior learning. Performance on the simulation accounts for 20% of the grade in the course. At the end of the semester, students were administered a questionnaire to assess their perceptions regarding simulation self-esteem and the various processes associated with the use of business simulations.

Measures

Each item in the questionnaire was measured on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). Of the 39 items on the scale, ten items were used to measure simulation self-esteem. Fifteen items were used to measure five independent variables (decision making process, involved in strategic decision making, involved in functional areas of decision making, involved in financial decision making, and team leader competence). An additional four items were used to measure how the simulation was learned (student manual, professor, peers, hands-on). Finally, a question about the expected course grade was converted to a five-point scale where an A = 5, B = 4, C = 3, D = 2, and F = 1. Additionally, there were nine questions that were demographic in nature.

Simulation self-esteem is the dependent variable and was measured using a ten item scale. The scale used is a slight modification of the Organization-Based Self Esteem (OBSE) scale developed by Pierce et al. (1989). Pierce & Gardner (2004) indicate that the OBSE scale can safely be used to branch out into a number of new areas of organizational research. Each item on the OBSE scale reflects an employee's perception of whether they think they are valuable, worthwhile, and effective members of their organization. Employees with high organizational self-esteem possess high levels of confidence (Gardner & Pierce, 1998). The modified scale used in this study included the words "In my simulated company" as a precursor to each question. Thus, each respondent was asked to indicate the degree to which they perceived that "in my simulated company, I counted," "in my simulated company, I was important," "in my simulated company, I was taken seriously," "in my simulated company, I was trusted," "in my simulated company, there was faith in me," "in my simulated company, I was valuable," "in my simulated company, I was helpful," "in my simulated company, I was efficient," "in my simulated company, I made new friends," and "in my simulated company, I made a difference." The ten items were aggregated to form the simulation self-esteem scale and had a Cronbach alpha of .91.

The independent variables in this study are decision making process (autocratic vs. democratic), involved in strategic decision making, involved in functional area decision making, involved in financial decision making, how the simulation was learned (student manual, professor, peers, hands-on), team leader competence, and the expected course grade. The scales used to measure the independent variables are discussed in the following sections.

Decision Making Process. Decision Making Process refers to the extent to which participants perceive simulation decisions were made democratically as a team. A two item scale was used to gather perceptions of whether "most of my decisions were authoritarian" (reverse scored) and "most of my group's decisions were made as a group." The two items were aggregated, and the scale had a Cronbach alpha of .64.

Involved in Functional Areas of Decision Making. Functional decision making involves making choices in the areas of production and operations, human resources, and marketing. A three item scale asked respondents to indicate whether they believed they were "most involved in the marketing part of the simulation," "most involved in the human resources part of the simulation," and "most involved in the production part of the simulation." The three items were combined to form the involved in functional areas of decision making scale with a Chronbach alpha of .67.

Involved in Financial Decision Making. Financial decision making includes monitoring the quarterly financial reports and making decisions to improve financial performance. A two item scale was used to assess student perceptions of whether they were "most involved in the financial analysis part of the simulation," and "when preparing a decision, most of my time was spent on financial analysis." The two items were combined to form the involved in financial decision making scale with a Cronbach alpha of .43.

Involved in Strategic Decision Making. Strategic decisions involve strengthening the long-term competitiveness of the firm by analyzing the competition and making decisions about issues such as quality, image, and customer service. A six item scale was used to gather perceptions of "when preparing my decision, most of my time was spent on analyzing the competition," "when preparing a decision, most of my time was spent on value chain analysis," "service was my company's greatest competency," "image was my company's greatest competency," "when preparing the decision, most of my time was spent on strategic analysis," and "quality was my company's greatest competency." The six items were combined to form the involved in strategic decision making scale with a Cronbach alpha of .70.

Team Leader Competence. A two item scale was used to gather perceptions about whether respondents believed "the person controlling the keyboard was the most competent person in my group," and "my team leader controlled the keyboard." The two items were combined to form the team leader competence scale with a Cronbach alpha of .73.

How the Simulation was learned. Students were asked to indicate the extent to which they "learned the simulation by reading the student manual," "learned the simulation from the professor," "learned the simulation from my peers," and "learned the simulation by hands-on experience." Because we wanted to investigate the contribution made by each method of learning, each question was used independently as a single item scale in order to investigate how students learned the simulation.

Expected Course Grade. One question was used to measure the expected course grade. In order to facilitate substantive comparisons and interpretations, the expected course grade question was converted to a five-point scale where an A = 5, B = 4, C = 3, D = 2, and F = 1.

DATA ANALYSES

A factor analysis with a varimax rotation was performed on the 15 statements in the questionnaire representing the independent variables. The factor analysis rendered five distinct factors that accounted for 62.73 percent of the total variance in simulation self-esteem. The five factors include *Involved in Strategic Decision Making* (16.90% of the variance), *Involved in Functional Decision Making* (13.26% of the variance), *Team Leader Competence (*12.14% of the variance), *Group Decision Making Process* (11.02% of the variance), and *Involved in Functional Decision Making (*9.45% of the variance). Additionally, the following items were included as single item independent variables: expected course grade, I learned the simulation by reading the manual, I learned the simulation from the professor, I learned the simulation from my peers, and I learned the simulation from hands-on experience. Before analyzing the data, the reliability of the scales was assessed by computing Cronbach alpha coefficients. Correlation and regression were utilized to test the hypotheses.

RESULTS

The results of this study are presented next. Descriptive statistics and correlations among study variables are shown in Table 1 with the reliability coefficients listed on the diagonal of the matrix. A diagram of the proposed relationships is depicted in Figure 1.

H1: A student's perception of how they learned the simulation (student manual, hands-on, a professor's lectures, and/or through peer interaction) will be directly related to the student's perceived simulation self-esteem.

Table 1: Means, Standard Deviations, and Correlations

Variable		Mean	s.d.	1	2	3	4	5	6	7	8	9	10
1	Manual	3.65	.91										
2	Professor	3.64	.99	.11									
3	Peers	3.36	1.08	-.02	.28*								
4	Hands-on	4.15	.79	-.07	.01	-.13							
5	Decision Making Process	2.95	.71	-.09	-.02	.28*	.23*	(.64)					
6	Expected Course Grade	4.29	.64	.06	-.11	-.06	.18	.21*					
7	Involved in Strategic Decisions	2.10	.40	.07	.10	.20*	.15	.15	.29*	(.71)			
8	Involved in Functional Decisions	2.45	.47	.03	.19	-.04	.25*	-.05	.10	.14	(.67)		
9	Involved in Financial Decisions	2.52	.52	.38*	.02	.03	-.04	.19	.31*	.11	.20	(.43)	
10	Leader Competence	2.79	.84	.02	-.06	.07	.19	.12	.06	-.04	.18	.24*	(.73)
11	Simulation Self-Esteem	4.29	.57	.10	-.09	.17	.42*	.46*	.32*	.32*	.22*	.32*	.28* (.91)

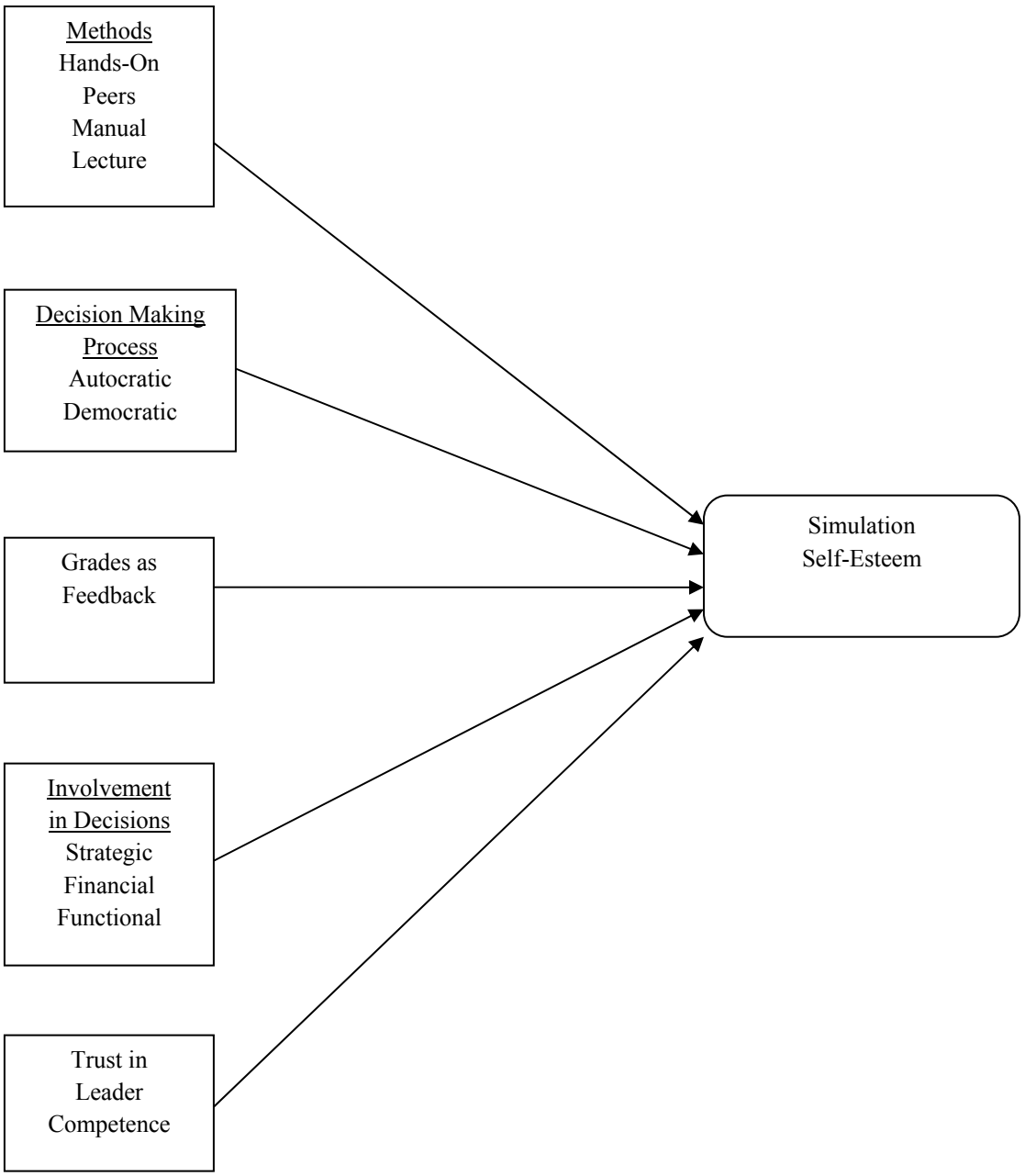
$p < .05$
Reliabilities are listed on the diagonal

As shown in Table 1, significant correlations exist between simulation self-esteem and learning the simulation by hands-on experience ($r = .42$, $p = .000$). Further, the regression analysis results shown in Table 2 indicate that simulation self-esteem can be predicted from how the students learned the simulation ($F = 8.71$, $p = .000$) with significant beta weights for learning from hands-on experience ($\beta = .469$, $p = .000$) and learning from peers ($\beta = .276$, $p = .004$). Thus, Hypothesis 1 is supported in that students who perceived that they learned the simulation from hands-on experience and from peers indicated that they had greater simulation self-esteem. Correlation and regression results between perceived simulation self-esteem and students who believed that they learned the simulation from the manual and from the professor were not significant.

Table 2: Results of Regression Analysis Predicting Simulation Self-Esteem Based on Teaching Methods

Predictor Variables	β	t	R^2	F	Sig.
Manual	.157	1.75			.083
Hands-on	.469	5.22			.000
Professor	-.182	-1.95			.054
Peers	.276	2.96			.004
Values of the Model			.275	8.71	.000

Figure 1: Model of Proposed Relationships Among Processes and Simulation Self-Esteem



H2: The student's perceptions of the decision making process (autocratic-democratic) will be related to the student's perceived simulation self-esteem.

In addition to the significant correlations shown in Table 1 between the perceived decision making process and simulation self-esteem (r = .46, p = .000), the results of the regression analysis provide further support for Hypothesis 2. As shown in Table 3, over 20% of the variance in simulation self-esteem can be predicted from the student's perception of the decision making process (F = 24.54, p = .000) with a significant beta (β = .455, p = .000). Thus, Hypothesis 2 is supported in that students who perceived that their decisions were made democratically rather than autocratically had higher perceived simulation self-esteem.

Table 3: Results of Regression Analysis Predicting Simulation Self-Esteem Based on Group Decision Making

Predictor Variables	β	t	R^2	F	Sig.
Decision Making Process	.455	4.95			.000
Values of the Model			.207	24.54	.000

H3: A student's expectation of their final course grade (A,B,C,D,and F) will be directly related to the student's perceived simulation self-esteem.

The regression analysis results shown in Table 4 indicate that 10% of the variance in simulation self-esteem can be predicted from the student's perceived expectation of their grade in the course (F =11.05, p =.001). The significant correlation shown in Table 1 between simulation self-esteem and expected course grade (r = .32, p = .001) and the significant beta weight (β = .323, p = .001) provide support for Hypothesis 3. Students who had expectations of a higher course grade reported higher simulation self-esteem. Thus, students who believed they were making an "A" in the course reported higher simulation self-esteem than those who expected a "C" in the course.

Table 4: Results of Regression Analysis Predicting Simulation Self-Esteem Based on Expected Course Grade

Predictor Variables	β	t	R^2	F	Sig.
Expected Course Grade	.323	3.32			.001
Values of the Model			.10	11.05	.001

H4: A student's perceived level of involvement (strategic decisions, functional area decisions, and financial decisions) will be directly related to the student's perceived simulation self-esteem.

As shown in Table 1, significant correlations exist between simulation self-esteem and involvement in strategic decisions (r = .32, p = .001) involvement in financial decisions (r = .32, p = .002), and involvement in functional decisions (r = .22, p = .033). Further, the results of regression analysis, as shown in Table 5, indicate that nearly 18% of the variance in simulation self-esteem is predicted from the student's perceived level of involvement in various aspects of the simulation (F = 6.59, p =.000) with a significant beta weight for involvement in strategic decisions (β = .209, p =.034) and a significant beta weight for involvement in financial decisions (β = .288, p =.004). The regression results and significant correlations provide support for Hypothesis 4. Thus, Hypothesis 4 is supported in that those students who perceived being more involved in strategic decisions and in financial decisions had higher simulation self-esteem. The level of involvement in the various functional areas (production, marketing, and human resources) was not significantly related to simulation self-esteem at p = .05.

Table 5: Results of Regression Analysis Predicting Simulation Self-Esteem Based on Involvement in Functional Decisions, Involvement in Strategic Decisions and Involvement in Financial Decisions

Predictor Variables	β	t	R^2	F	Sig.
Involved in Functional Decisions	.118	1.20			.232
Involved in Strategic Decisions	.209	2.16			.034
Involved in Financial Decisions	.288	2.98			.004
Values of the Model			.177	6.59	.000

H5: A student's perception of team leader competence will be directly related to the student's perceived simulation self-esteem.

In addition to the significant correlations shown in Table 1 between team leader competence and simulation self-esteem ($r = .28$, $p = .006$), the results of the regression analysis provide further support for Hypothesis 5. As shown in Table 6, approximately 8% of the variance in simulation self-esteem can be predicted from the student's perception of the team leader's competence ($F = 7.76$, $p = .006$) with a significant beta ($\beta = .275$, $p = .006$). Thus, Hypothesis 5 is supported in that students who indicated greater confidence in their team leader's competence had greater perceived simulation self-esteem.

Table 6: Results of Regression Analysis Predicting Simulation Self-Esteem Based on Leader Competence

Predictor Variables	β	t	R^2	F	Sig.
Trust in Leader Competence	.275	2.79			.006
Values of the Model			.08	7.76	.006

DISCUSSION

The purpose of this study was to investigate whether there are better ways to structure the processes associated with the use of business simulations in order to improve simulation self-esteem. Results of the study suggest that simulation self-esteem is enhanced when students learn the simulation from peers and from hands-on use, while there is a negative relationship between simulation self-esteem and learning the simulation from the professor. Thus, our research suggests that the explorations on the part of the student when learning a new topic can be profitable in terms of generating feelings of capability. It may serve the learner to rely less on instruction and more on their own mental efforts to make sense of and learn the simulation. One method to support peer and hands-on learning may be to set aside class time for students to work on learning the simulation while the instructor is present. Students would learn the simulation by working on it collaboratively, but if they had questions as they worked through the simulation, they would have the instructor accessible for answering questions.

The results of the study also indicate that perceptions of time spent on strategic and financial decisions were related to simulation self-esteem as well as being involved in group decision making. Perhaps students who spent more time studying financial results, developing a strategy, and discussing ideas with their groups were able to learn more deeply and thus feel more capable. Perceptions of time spent on functional area decisions were not related to simulation self-esteem. One explanation for this may be that total enterprise simulations tend to emphasize strategic and financial decision making that impacts the firm as a whole rather than specific functional areas.

A student's expectation of their overall course grade was related to simulation self-esteem. This finding is consistent with Crocker et al. (2003) who suggest that as a professor provides feedback to a student in the form of grades, the student will develop self-beliefs consistent with the grade achieved. Thus, instructors may be able to improve simulation self-esteem throughout the semester by putting grading emphasis on simulation assignments that

reinforce the learning objectives for the course and providing feedback on these assignments throughout the semester. Potential assignments to reinforce learning objectives may include having students develop a strategic plan, performing an internal and external analysis, identifying key problems or issues, and developing recommendations for their simulation company.

Lastly, the results of the study suggest that students who indicated greater confidence in their team leader's competence had greater perceived simulation self-esteem. This information may be useful when forming simulation teams. Rather than allowing students to self-select teams, it may be beneficial in terms of simulation self-esteem to have the professor create each team to ensure that teams are composed of members with diverse business majors. Such diversity may increase the likelihood of each team having members with expertise in some important aspect of running the simulation. Thus, when the team leader emerges, he or she may be perceived as more competent because of the expertise in his or her area of study.

The findings should be interpreted while keeping in mind the limitations of the study. First, as with all self-report constructs and measures, there can be problems with social desirability response bias. Especially at the end of the semester, students may have been tempted to inflate their responses to appear more knowledgeable. However, the surveys were filled out anonymously. Second, it is likely that the students' self-report measures of self-esteem, course evaluation, and so on will vary according to how well they score on the simulation. Lastly, the results apply to observations from one university and one business simulation. Similar analyses of different games need to be completed before generalized statements are made.

Given the long list of benefits associated with global self-esteem, future research on simulation self-esteem should build on the current study and investigate whether simulation self-esteem has an impact on a student's self-esteem in general. Further, while learning the simulation from the professor was not significantly related to simulation self-esteem in this study, it neared significance at .054. Perhaps future studies could further test this finding by studying specific professor techniques for teaching the simulation such as lecture only, demonstration, one-on-one office time, and group consulting.

CONCLUSION

The results of this study provide evidence that simulation self-esteem may be associated with student perceptions of team leader competence, various methods of teaching the simulation, and various aspects of student involvement in the simulation. One method to support peer and hands-on learning may be to allow class time for teams to work collaboratively on learning the simulation in a trial game while the instructor is accessible for answering questions. When providing class time for team simulation work, it may be beneficial to have a specific assignment for each class period rather than a general assignment to "work on the simulation". For example, require each team to work through at least 4 quarters of the simulation and then turn in their results to the professor. This approach gives the professor an opportunity to provide feedback and make suggestions for improvement to each team.

Additionally, instructors may be able to improve simulation self-esteem throughout the semester by putting grading emphasis on simulation assignments that reinforce the learning objectives for the course. Simulation related assignments may require a deeper level of involvement by students as they attempt to apply course concepts as they relate to their simulation company. Further, having a series of simulation assignments allows the instructor to provide feedback and simulation related grades throughout the semester. As suggested by Crocker et al. (2003), as a professor provides grading feedback to students, they will develop self-beliefs consistent with the grade achieved. Potential assignments to reinforce learning objectives for a capstone course may include having teams:

- Develop a strategic plan for their simulation company. This assignment would likely include writing a mission statement, setting objectives, and formulating strategies for the simulation company.
- Prepare an industry and competitive analysis which may include conducting a comparison of competitors in the simulation industry, identifying forces that are causing the simulation industry to change, and pinpointing the key factors for success in the simulation industry.
- Perform a company situation analysis for their simulation company. This assignment would likely entail a Financial and SWOT Analysis.
- Determine the major strategic issue(s) their simulation company is facing based on the analyses that were performed. Based on the strategic issue(s), each team should develop alternative solutions for addressing

the issue(s) and make a recommendation of which alternative(s) their simulation company should implement.

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The Synergistic Effect of Matrix Learning: A Case Study Using Matrix Learning in Business Classes

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ABSTRACT

The purpose of this paper is to present matrix learning as an approach for developing teamwork, synergy, and critical thinking in business classes. Matrix learning is a cooperative learning technique, where students discuss concepts, present arguments and counter arguments, and develop critical thinking skills. Students also realize positive learning benefits like empowerment and responsible association. Matrix learning maximizes performance, morale, and well-being of students. Numerous researchers have studied the effects of the use of cooperative learning on student achievement from reading comprehension and English as a second language to chemistry and engineering to elementary teacher education and the development of psychomotor learning in gymnastics (Artut & Tarim, 2007; Doymus, 2008; Ghaith & Bouzeineddine, 2003; Gömleksiz, 2007; Shaaban, 2006). While most have reported positive effects on learning, researchers do not argue that cooperative learning techniques are equally efficacious for all learning. Cooperative learning does not seem to work well, for example, in the development of psychomotor learning (O'Leary & Griggs, 2010); and some students have negative opinions, regarding group work as being "a waste of time" (Greenop, 2007). Overall, however, researchers (Ghaith & El-Malak, 2004; Johnson, Johnson, and Smith, 1991; Joyce, 1999; McKeachie, 1988; Slavin, 1987;) have reported that cooperative learning techniques like matrix learning are significantly more effective than traditional methods in terms of achievement, but are superior in terms of fostering group affection and respect. Matrix learning allows students to assume some responsibility for their own learning.

Keywords: Pedagogy, student-centered learning, critical thinking

INTRODUCTION

"The heart of most jobs, especially the higher-paying more interesting jobs, is teamwork. Teamwork involves getting others to cooperate, leading others, coping with complex power and influence issues, and helping solve interpersonal problems. Teamwork involves communication, effective coordination, and divisions of labor" (Johnson et al., 1991). Teamwork, communication, and division of labor are activities employers expect, according to Johnson, Johnson, & Johnson-Holubec (1990); and pedagogical theorists contend that classrooms, where students typically work independently from and in competition with others, should realistically reflect the teamwork required in today's business environment. The purpose of this paper, therefore, is to present matrix learning as an approach for developing teamwork, synergy, and critical thinking in business classes—critical skills needed in the business world.

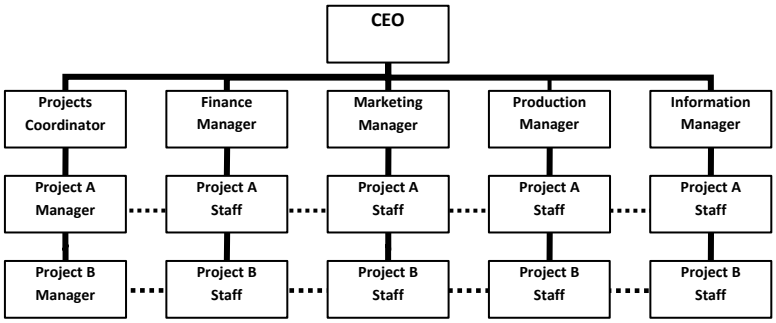
THEORETICAL FRAMEWORK

Generally, employees within departments in large organizations report to departmental managers or supervisors, who are responsible for the performance of their particular departments or units. Some organizations reconfigure this standard reporting structure into what is known as a matrix in order to capitalize on organizational resources and expertise that exist throughout the organization. In a matrix organization, resources are assigned from multiple departments and power is shared between functional managers and project managers. Functional managers assign employees to a project, while project managers assign employees tasks associated with their project. Project managers and functional managers share the responsibility of performance. This calls for a balance of power between the two, while allowing pooling and sharing of resources.

The sharing of resources, which includes human resources, is an important advantage of the matrix structure. Organizations attempt to create synergism through shared resources and responsibility between functional and project leadership. Boeing, the world's largest aerospace company and leading manufacturer of commercial jetliners and defense systems, utilizes the matrix structure to manage its many divisions: commercial and military

aircraft, satellites, weapons, etc. The matrix structure allows collaboration among the many divisions. Figure 1 illustrates a typical matrix structure.

Figure 1: Typical Matrix Structure



Cooperative Learning

When students work together to complete a specific task, they develop leadership skills and the ability to work with others: students are active in their own learning; they share ideas and seek information; they make decisions regarding assigned tasks. Cooperative learning falls within the social constructivism paradigm, where each learner, with his or her uniqueness and complexity, is encouraged to arrive at a personal version of truth (McMahon, 1997). Constructivism, according to Smith (2000) is about knowledge and learning—knowledge is temporary, developmental, and socially and culturally mediated.

Numerous researchers have studied the effects of the use of cooperative learning on student achievement from reading comprehension and English as a second language to chemistry and engineering to elementary teacher education and the development of psychomotor learning in gymnastics (Artut & Tarim, 2007; Doymus, 2008; Ghaith & Bouzeineddine, 2003; Gömleksiz, 2007; Shaaban, 2006). Johnson, Johnson, and Stanne (2000) indicated that cooperative learning is based on theory, validated through research, and outfitted with clear procedures that fit a wide range of academic environments. With over 600 published studies, more is known about the efficacy of cooperative learning than lecture and other instructional methods (Johnson et al., 1991).

Slavin (1990) asserted that students should be actively involved in the learning process. Students become empowered as they share ideas, seek information, make decisions, and present findings—they learn, while they tutor/teach their peers. Steiner, Stromwall, Brzuzy, and Gerdes (1999) insisted that students engaged in cooperative learning are empowered through interpersonal interdependence, social skills, group dynamics, conflict resolution, and critical thinking. In addition to empowering students, cooperative learning helps increase student retention. When students are actively involved in their own learning, they are more likely to realize success. As students work together, they create an interdependence that results in responsibility for each other. Teams, therefore, draw upon the talents and skills that each member brings to the group—pooling their abilities, allowing the team to explore more challenging content, while reducing the frustration often associated with individual exploration leading to a synergistic result. Macpherson (1999) offered additional insight into the use of cooperative learning where students assess the work of their peers. After working together and assessing each other's work in one semester, Macpherson noted no significant difference between peer-assigned grades and teacher-assigned grades in a second semester. Students had developed sufficient critical thinking skills to discriminate, as would a teacher, between mastery and mediocre performance.

Discussion and debate, with feedback, are features of cooperative learning techniques. Totten, Sills, Digby, and Russ (1991) endorsed cooperative learning because it gives students opportunities to engage in discussion, to take responsibility for their own learning, and to become critical thinkers. Students share points of view, present arguments and counter arguments, which enhance critical thinking skills. Gillies (2006) concluded that students who work in cooperative classrooms use more facilitative learning behaviors and exhibit more positive behaviors. Synergy occurs, as supported by Mercer, Wegerif, and Dawes (1999), when students are taught how to engage each other in exploratory discussion where they engage critically but constructively with each other's ideas. Additionally,

richer discussions or higher quality discourse and higher scores on post-discussion assessments occur, as explained by Chinn, O'Donnell, and Jinks (2000), when students are required to detail/defend their reasoning.

Benefits and Challenges

The benefits for using cooperative learning include improved interpersonal, ethnic and cultural awareness and better academic performance. Aronson, Blaney, Sikes, Stephan, and Snapp (1975), identified two barriers to effective instruction. The first barrier to effective classroom instruction is society's obsession with winning. Students learn to view others as competitors for the limited resources and rewards of the traditional classroom. The second barrier to effective classroom instruction was the school desegregation movement of the early 1970s. Students from various racial and social backgrounds were being brought together without a mechanism to ensure beneficial interaction, which was the movement's goal. Observation reported by Aronson et al. (1975) seems quite the norm: students tend not to integrate; they hang together in their own ethnic groups. While racial integration is no longer a paramount concern, there is today, at least in post-secondary schools, a strong international element in the student body. Teachers need a way to get racially and culturally diverse groups to interact—cooperative learning is such a way. Allison and Rehm (2007) and Lord (1997, 2001) advocated cooperative learning as an important tool for teachers who must be responsive to today's diverse classroom. Cooperative learning benefits students who are culturally, ethnically and linguistically diverse.

Students perform better in cooperative learning environments and learn to be effective analysts and mediators of complex social situations. This conductive effect responsible for developing critical thinking skills is a benefit according to Steiner et al. (1999). Aronson and Patnoe (1997) depicted cooperative learning as a way to improve students' mastery of material, attendance, self-esteem, and social responsiveness to classmates. They also pointed out that the use cooperative learning techniques result in greater empathy for others, including those of different backgrounds, races and genders. In many instances today, cooperative learning increases students' understanding and tolerance for interaction with international students. Students in cooperative learning environments feel more relaxed and freer in the classroom, and they report improvements in attitudes toward the subject and reported more positive relationships among students (Sachs, Candlin, & Rose, 2003; Al-Weher, 2004). Smith, Johnson, and Johnson (1981) reported that students in cooperative learning environments achieve higher levels of understanding and retention when they share ideas and attempt to understand others. Colosi and Zales (1998) found that students in cooperative learning environments were more engaged and more interested than students in their control group—they took on more responsibility for their own learning, were more actively involved, and relied more on each other for information. Other researchers (McKeachie, 1988; Slavin, 1987; Johnson et al., 1991) supported cooperative learning because students understand and retain information better and for longer periods of time. Additionally, Joyce (1999) argued that students in cooperative learning groups make better grades than students in traditional instructional situations and they achieve scores significantly higher when group membership is consistent throughout the term.

Matrix Learning

Cooperative learning is found in many of the techniques used by teachers from kindergarten to graduate school. Richard Stonehouse (personal communication, January 1981), a professor of geology at Michigan State University in 1981, led a workshop on matrix learning for graduate assistants. He recommended matrix learning as an innovative technique to reduce the tedium that can be present in traditional instruction. In addition, he supported matrix learning as a way to counteract the passivity of some students, making them an integral part of the teaching/learning process, with peer pressure present to promote performance. Johnson et al. (1990) offered the following requirements for successful cooperative learning groups: positive interdependence, heterogeneous membership, shared leadership, and group processing.

Students develop from the sharing and interaction that is typical in matrix learning and other cooperative learning techniques. They also develop greater skill to solve complex problems: analysis and synthesis. Webb (1982) suggested that higher level thinking skills are developed when students use cooperative learning. Further, Hwang, Lui, & Tong, 2005 (2005) and Earl (2009) found that cooperative learning positively affected learning outcome when students were faced with harder or less straightforward assignments. Cooperative learning as achieved through matrix learning is closely related to William G. Perry's contextual relativism, (Perry, 1981, as cited in Persky & Pollock, 2009), where students' perspectives of the world are transformed—they begin to think independently, analyze problems and synthesize their responses.

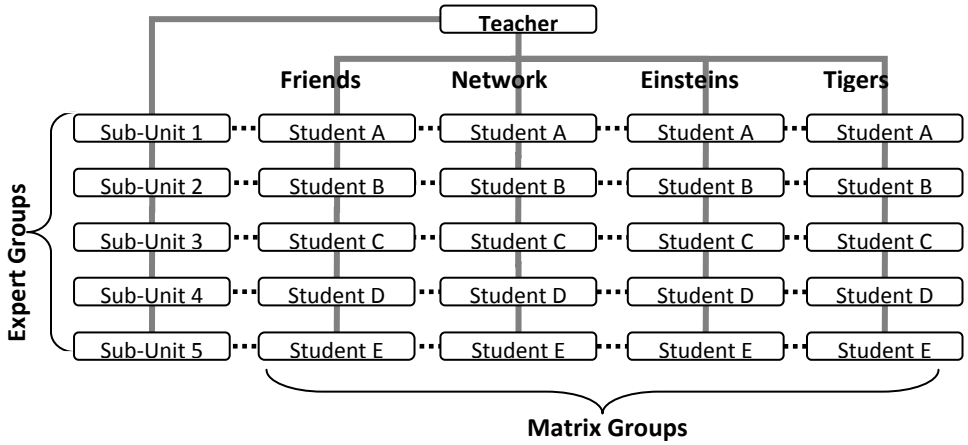
Impact on Students

Matrix learning offers many advantages. Students are more engaged in learning rather than passively listening to their teachers. They formulate ideas about a concept, discuss those ideas, and share ideas with group members. Nelson-Le Gall (1992) argued that learning is the result of continuous, dynamic negotiation between students; and social sharing through cognitive learning activities, like debate, enhance critical thinking skills. Social sharing through cognitive activities is a corner stone of matrix learning. Students benefit from working in groups by expressing themselves. Typically more advanced students initiate analysis of the material, which stimulates critical thinking. Lizzio and Wilson (2005) suggested that the exchange of ideas encourages the development of higher order skills and increases the potential for student learning. Traditional methods, which some students prefer, with lock-step procedures and prescriptive rules, is antithetical to what educators want and society needs in educating future scientists, leaders and executives.

Matrix learning is a technique that capitalizes on small group dynamics, which are usually present in higher education classrooms. The difference, however, is that in matrix learning group interaction is the instructional technique rather than a social or remediation technique. Business educators should become familiar with matrix learning (Goings & Krizan, 1988). Koh, Wang, Tan, Liu, and Ee (2009) proposed cooperative learning because students value the benefits derived from the process. They develop transferable skills useful in social interaction, communication, collaboration, and management. Through social interaction they learn from each other how to analyze and synthesize content into new learning. Langlois (2001) reported that her students discovered that they were more confident in their ability to appropriately address statistical applications to answer research questions and the relationship aspect of matrix learning carried through to their study groups at the end of the term.

Matrix learning uses a structure similar to that used in matrix organizations, but students and teachers, not functional area and project managers, take on the responsibility of performance. The learning process is broken into parts by the teacher, and students work individually to develop understanding of assigned concepts or they can review teacher-prepared modules that cover assigned concepts. Once students have had time on their own to prepare their individual responses or rehearse, they work in "expert" groups to check their understanding and share ideas for presenting their piece of the concept. When students have sufficiently acquired competence in their expert groups, they reconfigure the group membership to teach their individual component of the concept to the members of their matrix groups. These reconfigured groups, called matrix groups, allow students to contribute a different part of the concept. Each student explains his or her portion of the concept to the others, allowing the entire group to learn the whole concept. Figure 2 illustrates a typical matrix learning structure, where 4 five-member groups (Friends, Network, Einsteins, and Tigers) interact to cooperatively learn sub-units 1 through 5. The number of sub-units is not important—two students, for example, could find themselves in the same expert group as well as in the same matrix group.

Figure 2: Illustration of Matrix Learning Groups



Matrix learning is a cooperative learning technique that uses small diverse teams to improve student understanding of a subject or concept. Each member of a matrix team is responsible for learning part of a subject or concept—he or she is also responsible for helping teammates to learn. This responsibility creates a positive learning environment of

interdependence and cooperative achievement required to achieve success in today's global, dynamic business environment, while improving individual and group achievement (Henderson & Martin, 2002; Köse, Sahin, Ergün, & Gezer, 2010; Hwang et al., 2005; Tuan, 2010). Lord (1997, 2001) suggested that cooperative learning strategies, like matrix learning, have more to offer than traditional instruction methodologies. Students are better prepared to think through complex problems and experiment with solutions, and they are more likely to use their imaginations and appreciate diversity. Allison and Rehm (2007) emphasized the value that cooperative learning brings to diverse learning environments. Students interact and communicate with each other on task-related activities; and for students whose second language is English, cooperative learning provides valuable opportunities for learn and practice.

Students benefit from their interaction in matrix learning as they develop critical thinking skills. They also benefit because they use multiple learning styles (Midkiff & Thomasson, 1993). Kinesthetic, auditory, and visual learners benefit from the activities in matrix learning. They work with their hands to manipulate materials and write; they discuss content; and they watch movement and expression (Goings & Goings, 1998). Students who work in groups also experience reduced anxiety and stress levels (Burron, James, & Ambrosio, 1993).

Obstacles

Matrix learning is not without its opponents or obstacles. At the forefront of these challenges is teacher resistance. Teachers, especially university professors, are more familiar with traditional lecture-centered teaching; and cooperative learning strategies are time-consuming. They may be unwilling to adapt to the role of facilitator, taking on a different set of skills than is typically used in teaching (Fang, Kang, & Feng, 2009). Hill (1982) and Langer and Beneventi (1978) argued that cooperative learning is too time-consuming and too diffuse in responsibility to affect high levels of learning for complex material.

Teachers may also be put off by the freedom that is necessarily given to students when engaging students in learning is the objective (Smith, 2000). Al-Weher (2004) warned that teachers must also be watchful for errors that students make as they attempt to relate their individual portions of a concept in their matrix groups. This added responsibility over traditional lecture of assessing students' ability and competence to "teach," while providing a non-threatening environment could have a detrimental effect upon a teacher's willingness to explore the benefits of matrix learning.

Researchers have most often reported positive results on learning attributed to cooperative learning. The technique does not work well from every subject or discipline, however. Cooperative learning, for example, does not seem to work well in the development of psychomotor learning (O'Leary & Griggs, 2010). Additionally, Berger and Hänze (2009) reported that students in expert groups were more competent with their individual portions of the concept under study than the members in their matrix groups. This, they deduced is the result of the intensive interaction with one portion of the concept and the students' expectancy associated with teaching their fellow students in matrix groups.

Students have also hold negative opinions regarding the use of cooperative learning techniques like matrix learning. Some students regard group activity as "a waste of time" (Greenop, 2007). Lizzio and Wilson (2005) argued that students prefer traditional methods, with lock-step procedures and prescriptive rules, to cooperative learning strategies where responsibilities are shared by teacher and students. Students also complain about lack of content knowledge—usually provided by a teacher—when their peers are responsible for instruction (O'Leary & Griggs, 2010).

THE PROCESS

Matrix learning can be used at any level, with any size class. The authors have used matrix learning at Georgia College with their students in business communication, legal environment of business, and business law classes. The process uses matrix groups and expert groups. Matrix groups consist of a cross-section of the class membership—balanced for academic, cultural, and racial diversity. Academic balance can be achieved by distributing students based on the results from an exam or quiz. After academic balance is achieved, a teacher should consider refinements between groups to balance gender, race, and cultural distinctions. Each member of a matrix group is given a separate sub-unit of a concept. Students for each matrix group having identical pieces or sub-units of a concept then convene in expert groups, where they discuss their identical content and help each other learn the same sub-unit. In expert groups, students analyze, synthesize, and prepare to teach their matrix group

members. After sufficient preparation, students reconvene in their matrix groups where each member has a unique contribution to make so that each student in the matrix group is exposed and "taught" the entire content of the concept being addressed. Teachers interested in experimenting with matrix learning can follow eight steps—they would:

1. *Divide a unit of instruction into as many parts as the classroom will have matrix groups***.** Each major aspect of a unit should be contained in a separate sub-unit so that each matrix group will have within its membership the entire unit of instruction. A special unit on bailment law, for example, might be divided into three sub-units: (1) general principles of bailment law, (2) types of bailments, (3) responsibilities of bailors and bailees. A unit on sampling for research reporting in business communication could easily be divided into four, five, or six parts, depending upon a teacher's focus. Topics for expert groups could be simple random sampling, stratified random sampling, and systematic random sampling. Additional expert groups could be added to explore quota sampling, convenience sampling or other topics like determining sample size or the advantages of sampling.

   In order for the technique to be effective, care must be taken to ensure that the sub-units are self-contained and can stand alone. Each matrix group member is responsible for learning a separate sub-unit and then teaching it to other students in his/her matrix group. In addition to the sub-units, the teacher could add related information by using more traditional techniques. The teacher might, for example, give a short lecture on bailment law before students begin their matrix learning activity. Students could also be assigned different outside readings and use the matrix learning to quickly cover the material.

2. *Divide the traditional classroom into groups of students***.** Care should be taken to ensure that each matrix group represents a cross-section of the class in diversity and achievement. Students should be assigned to matrix groups rather than being allowed to self-select membership. In order to easily achieve equivalent academic groups, teachers could divide students by five; as Aronson, Blaney, Stephan, Sikes, and Snapp (1978) suggest, groups of five work best. Teachers should not be concerned if the division results in uneven and odd sized groups. Different sized groups have been used; groups of three for business communication projects and groups of four for projects in legal environment of business (LENB) projects seems to work best at Georgia College. LENB classes tended to run larger than business communication classes, so more matrix groups are required; but more than three or four students in the matrix group for LENB classes was not as effective.

3. *Rank the class on some past performance and assign students to matrix groups***.** Readily available test scores, GPAs, or other measures of achievement can be used to create equivalent groups based on achievement. Teachers would use letters (A, B, C, D, and E) to assign students to matrix groups. Teachers letter the highest and lowest ranked scores A (the first group's letter), letter the second highest and second lowest ranked scores letter B (the second group's letter) and so on. Teachers continue lettering, assigning the next highest ranked and the next lowest ranked students until all students are assigned. In order to create equivalent groups, continue the lettering process in the opposite direction: at first assigning A, B, C, D, E, then assigning E, D, C, B, A. Table 1 shows how a classroom of 20 students could be ranked academically and then assigned to matrix groups. This procedure ensures that groups will be composed of students whose academic performance ranges from high to low, as suggested by Slavin (1977).

Table 1: Rank Ordering and Matrix Group Assignments for a Typical Class

Students and Scores Earned on Mid-Term Exam

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
99	95	92	87	86	84	82	80	79	78	77	76	65	74	72	71	70	66	62	50

Group Assignment

A	B	C	D	E	E	D	C	B	A	A	B	C	D	E	E	D	C	B	A

Teachers should check their matrix groups for diversity balance and change assignments by swapping students of the same academic performance but of different background, race, or sex. Students' background, maturity, work habits, and other variables will, of course, affect the true equality of matrix groups. In working with the

four expert groups in LENB classes, students were assigned by their rank in a distribution of scores on a mid-term exam. Average performance on the mid-term per group is presented below—nearly equivalent groups resulted from Step 3.

Group A	Group B	Group C	Group D	Group E
76	78	76	78	78

4. *Have the members of each matrix group give their group a name***.** At the end of the Step 3, a classroom of 20 students would populate four matrix groups and have five student members each. It will be important for teachers to refer to the matrix groups by name. Naming gives group members a social structure that creates a sense of recognition and sets expectations with regard to others within the group (Stets & Burke, 2000). This sense of identity aids in the development of group dynamics skills. Matrix groups could use *fanciful* names like Friends, Network, Einsteins, and Tigers.

5. *Rearrange matrix groups into expert groups (A through E)***.** Students were assigned to groups using the letters A, B, C, D, and E; now, students will regroup by assigned letter into expert groups. Each student in a matrix group joins the other members of the class who were previous assigned the same letter, with all As coming together, all Bs coming together, all Cs coming together, etc.

6. *Give each member of the separate expert groups a distinct piece of the instructional unit that was developed in Step1***.** Each of the students in expert group A is given a copy of the same sub-unit. Students in the other four sub-units (B, C, D, and E) would be given a different sub-unit per expert group. Sufficient time is then allowed for students to share ideas, rehearse, and prepare to teach their sub-unit to the other members of their separate, named matrix groups once the matrix groups reassemble.

7. *Recall matrix groups so that the "experts" from groups A, B, C, D, and E can teach their unique sub-unit to the other students in their matrix group*. It is advisable to collect any written materials made available to the various expert groups at this time. Once students have returned to their matrix groups, each student will have time to teach his or her sub-unit to the other students in his or her matrix group. Group members must listen to each other carefully, question each other purposefully, and reinforce each other patiently in order to learn all the sub-units that make up the instructional unit. If the experts retain written materials, other students in the matrix group will want to read the other material rather than relying on the instruction given by the expert, thus taking instruction out of the hands of the experts and each person will pursue what it is he or she gets from reading all the material.

8. *Return to classroom mode and quiz students over all sub-parts of the instructional unit***.**

METHOD

This paper reports the results of a study of matrix learning in business communication and legal environment of business (LENB) classes at Georgia College. The instructional units used in this study were legal cases and were chosen because they required students to use deductive reasoning—a skill teachers need to reinforce for all students. The particular areas of law presented in this study were unfamiliar to students in both business communication classes and LENB. Having to depend on others for pieces of the information was a new experience for nearly all students.

Two business communication classes and two LENB classes were used in this study. Two cases in bailment law were divided into three sub-units: (1) general principles of bailment law; (2) types of bailments; and (3) responsibilities of bailors and bailees in the business communication classes, and added a fourth sub-unit, situational liabilities of bailees in the LENB classes. The additional sub-unit was to accommodate a larger class size.

In the first of two participating business communication classes, 21 students were assigned to three matrix groups of seven students each. One third of the applicable bailment law was given to each student. Students then regrouped into expert groups (Group A, Group B, etc.), depending upon the portion of law they have been given. After the students in the expert groups had analyzed, digested, and rehearsed their individual parts, they regrouped into their matrix groups to discuss bailments in full, each student taking his or her turn to inform and instruct other students in

the group. Most students (92%) indicated that their experience using matrix learning was positive. Although 96% of the class reached the correct answer, only 48% provided credible answers to the case. Similar activity took place in the second business communication class that dealt with contracts, resulting in positive comments by most students (81%).

Activity in the two LENB classes mirrored that in the business communication classes, with one exception. These classes were larger, so the three groups were larger (9 students) for the bailments case. Contract law was the subject matter the next week, and group size was adjusted. Classes were divided into six matrix and six expert groups, and group size was reduced to four or five students each. For the bailments exercise, the overall positive response from students was 65%, whereby, after the contracts exercise, the positive response rose to 86%. As for the results, 69% of the students did credible work on the case analyses.

RESULTS

One LENB student, at the end of the semester expressed regret that she could not do more matrix learning scenarios as she found the method to be a superior way of learning the material. Student assessment of matrix learning is encouraging and indicates, as shown in Table 2, that the technique is 'effective' to 'highly effective' for their learning.

Table 2: Student Assessment of the Learning Experience

Courses	Highly Effective	Effective	Moderately Effective	Not Effective	Totals
LENB (n=32)	28%	56%	7%	9%	100%
BCOM (n=26)	23%	69%	4%	4%	100%

Students in the business communication classes also analyzed cases individually. Both classes had worked in groups in a team building activity, but they had no experience with matrix learning when the exercise began. One class, using the bailments case, did individual work before their experience with matrix learning; and the other did individual work, using the contracts case, after they had experienced the matrix learning activity. The class without experience in matrix learning had a credible answer rate of only 36%, while the class that had experience with the technique had a credible answer rate of only 14%. It is interesting that the second class thought the contract case was easier. The low credibility rate was more due to emotional responses than a clear application of the applicable law. Students in both classes rated the matrix learning experience a more valuable learning experience than their individual analytical experiences. The students working with bailments individually rated their previous team building activity more highly (73%) than their individual activity. The students who analyzed the contracts case rated group activity more highly also (64%) than their individual work. This experience in matrix learning will be used in the business communication classes for the unit on correspondence. Students will apply their knowledge of bailments by writing a persuasive letter.

DISCUSSION

Students in both the business communication classes and the LENB classes expressed positive remarks concerning their experience with matrix learning. The following are representative comments from business communication students (a research finding and citation follows each):

- "Doing the project in a group helped get a very organized explanation from each section. While considering the opinions of my group mates, I improved and added to my own. It's nice to consider a different point of view." [shared ideas; social sharing of cognitive activity: Nelson-Le Gall, 1992]
- "The group was able to understand the message much faster than we would have on our own, in my opinion." [efficacy of cooperative learning: Johnson et al., 1991; Webb, 1982]
- "It was helpful to have several opinions on a topic, especially when trying to decide the meaning of a word or phrase that is unclear. Also, when working as a group, you have the advantage of seeing aspects that you might not have picked up alone." [realize success: Slavin 1990]
- "Working together and listening to everyone made the project more clear. It is easier because everyone had a specific part to share." [create interdependence: Aronson & Patnoe, 1997]

- "There must be a certain amount of trust from each person in believing the relayed information. It was important to explain and give examples that the other members could relate to." [responsiveness to classmates: Aronson & Patnoe, 1997]
- "It was like piecing a puzzle together. We used different techniques to make sure that our group communicated effectively. I liked the activity because it was not boring." [Webb, 1982]
- "The first group meeting [expert group] helped clarify the information we were presented with. Therefore, it was easier to understand what information we were responsible for. In the second group [matrix group] the contribution from each group solidified the ideas and concepts for me." [critical thinking skills: Nelson-Le Gall, 1992; Webb, 1982]
- "I thought that doing this activity was a good idea. The reason was that it made each person listen, talk, think, and depend on others." [interdependence: Aronson & Patnoe, 1997; multiple learning styles: Midkiff & Thomasson, 1993]
- "It made us pay attention to the individual parts because we had to explain it to others later on. I probably would not have been able to discuss and understand the information as well if it was given to me alone." [empowerment, peer tutoring: Aronson & Patnoe, 1997]

Following are representative comments by legal environment of business students (a research finding and citation follows each):

- "I enjoy these groups because I am learning the material but in a more interesting way. I am more involved, which gets me thinking more." [engaged in learning process: Slavin, 1990]
- "Working in a group setting made the material easier to digest/understand. Playing ideas off one another helped to come to a conclusion in a timely fashion. Good experience over all!" [own ideas about a concept and discuss and share: Nelson-Le Gall, 1992; Smith et al., 1981; Webb, 1982]
- "This was a good group exercise and forced me to look outside the box a little. My group members and I worked well together as a team." [enhances critical thinking skills: Nelson-Le Gall, 1992]
- "I enjoy hearing insights from other students; I always get something out of the law or case I didn't really think about." [engaged in learning process: Slavin, 1990]
- "I liked the fact that our groups were chosen for us so we could get to know other students. I also like that it was organized as a puzzle; it made me think a little more about the legal issue." [teacher constructed groups: Aronson et al., 1978]
- "It forces us to cooperate and function with each other and makes me remember the assignment much clearer." [retention of the material: Slavin, 1990; Smith, et al., 1981]

Students in matrix groups are forced to help each other to become more articulate. The effect of each interaction allows students to realize that other students in their group have a worthwhile part to play in their learning. Also, it is through this kind of interaction that students from different racial and social backgrounds begin to learn that they and everyone else are more alike than different. They quickly develop an appreciation for diversity. Students also learn two important lessons: (1) in order to do well, each student needs the content the other students were given in their expert groups and they need the interaction and discussion in their matrix group, and (2) each student has a unique and essential contribution to make.

The minor problems encountered included dealing with students who dislike group work, controlling the size of matrix groups and having matrix groups reassemble without having written materials available during their case analysis. The latter two problems were resolved after some trial and error. Smaller matrix groups functioned better than larger groups and, by not having instructional materials available when matrix groups reassembled, students were forced to be interdependent in working the assigned problem. However, for students who prefer solo learning, there is occasional reluctance to fully participate. When this occurs in traditional group projects, several members of the group may be inactive and let others in the group do the majority of the work. The matrix learning technique, however, does not allow a member of a matrix group to be passive. The contribution of each member is required to complete the project—this is what prompts most educators to refer to the matrix technique as jigsaw. Joyce (1999) suggests that productive group members can extract participation from free riders through open, direct communication or penalize free riders through peer evaluation. One further point is that initially a matrix learning project is going to take careful preparation by the teacher if it is going to be successful. Also, matrix learning is more time consuming for any singular project than may be for a more traditional teaching method. If the outcome is indicative of what was gleaned the experience of using matrix learning in LENB and business communication, however, the time and effort are well worthwhile.

Matrix learning requires teachers to prepare better units of instruction and to think differently about their role in instruction. They could have more classroom time, however, to work with small groups of students. Matrix learning allows for a minimum of lecture and other teacher controlled instructional techniques to free teachers and students from some of the tedium and stress so often associated with traditional classroom instruction. Teachers in post-secondary institutions can use matrix learning to enhance traditional instruction without sacrificing valuable classroom time. Once introduced to the technique, students can use matrix learning for outside study sessions. For example, a teacher could encourage students to use matrix learning as a way to learn various sampling methods or to learn scales of measurement early in a statistics class. Outside study groups could well use matrix learning to cover content not sufficiently covered in traditional instruction.

CONCLUSION

Matrix learning maximizes performance, morale, and well being of students. Numerous researchers have concluded that cooperative learning techniques, like matrix learning, are as effective or superior to traditional methods in terms of achievement, but are superior in terms of fostering group affection and respect (Aronson et al., 1975; Johnson et al., 1991). Matrix learning contributes to the learning process in ways traditional learning cannot. The technique requires passive students to contribute within the group who may otherwise be apprehensive in front of an entire class. The technique also challenges students to "solve the puzzle" and offers a diversion from typical listening to lectures and notetaking. Matrix learning acquaints students with other students they may not interact with under normal circumstances; but most of all, the technique allows students to learn as they share the learning experience by teaching others.

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Manuscript Guidelines, Submission and Review Process

TOPIC AREAS (BUT NOT LIMITED TO THESE):

- Course design – current courses, new courses, new trends in course topics
- Course management – successful policies for attendance, homework, academic honesty …
- Class material
  - o Description and use of new cases or material
  - o Lecture notes, particularly new and emerging topics not covered effectively in textbooks
  - o Innovative class activities and action-learning – games, active learning, problem based
- Major or emphasis area program design that is new or innovative.
- Assessment – all aspects including AACSB and university level assessment strategies and programs
- Integration of programs or courses with other academic disciplines
- Internship programs
- Business partnerships
- Successful student job placement strategies
- Any topic that relates to higher education business education.

SUBMISSION AND REVIEW PROCESS:

Copyright

- Manuscripts submitted for publication should be original contributions and should not be under consideration with another journal.
- Authors submitting a manuscript for publication warrant that the work is not an infringement of any existing copyright, infringement of proprietary right, invasion of privacy, or libel and will indemnify, defend, and hold Elm Street Press harmless from any damages, expenses, and costs against any breach of such warranty.

Prepare your manuscript

- See the Style Guideline page for specific instructions.
- Articles must make a contribution to business education innovation.
- Manuscripts should be limited to 8 to 10 pages or less, although longer will be accepted if warranted.
- Articles can be either regular research papers, or shorter notes that succinctly describe innovative classroom teaching methods or activities.
- Manuscripts should be completely finished documents ready for publication if accepted.
- Manuscripts must be in standard acceptable English grammatical construction.
- Manuscripts should be in MS Office Word format. Word 2007 files are acceptable, as are earlier versions of Word. If you are using a new version of Word after Word 2007, save in Word 2007 format.

Submit your manuscript

- Manuscripts may not have been published previously or be under review with another journal.
- Submit the manuscript attached to an email to **submit@beijournal.com**
- We will respond that we have received the manuscript.
- Article submissions can be made at any time.
- Submission deadlines: September 15 for December issue, March 15 for June issue.

Manuscript review

- The editor and reviewers will review your submission to determine if 1) the content makes a contribution to innovative business education, 2) is of the proper page length, 3) is written in proper grammatical English, and 4) is formatted ready for publication.
- Submissions not meeting any of these standards will be returned. You are invited to make revisions and resubmit.
- If the submission meets the standards, the manuscript will be sent to two reviewers who will read, evaluate and comment on your submission.
- The editor will evaluate the reviews and make the final decision. There are 3 possible outcomes:
    - Accept as is.
    - Accept with minor revisions.
    - Not accepted.
- Reviews will be returned promptly. Our commitment is to have a decision to you in less than two months.
- If your paper is not accepted, the evaluation may contain comments from reviewers. You are invited to rewrite and submit again.

If your paper is accepted

- Minor revision suggestions will be transmitted back to you.
- Revise and send back as quickly as possible to meet printer deadlines.
- Upon final acceptance, we will bill you publication fees. See www.beijournal.com for latest per page fees. Sole author fees are discounted.
- The fees include all costs of mailing a copy of the issue to each author via standard postal ground.
- Delivery to locations outside the continental US will cost an additional $10 per author for 5 day delivery.
- Faster delivery methods are available for US and international delivery. Contact the editor for a specific pricing.
- All publication fees should be remitted within 10 business days of acceptance, if possible.
- If you decide not to publish your paper with BEI Journal after submitting payment, we will refund publication fees less $200 to cover costs of review and processing.
- Cancellation cannot occur after the paper has been formatted into the final printer's file.

Manuscript Style Guide and Example

An example is providing following these instructions.
This style guide represents new style guidelines in effect for future issues.

General Setup:

- All fonts: Times New Roman. 10 point for text. Other sizes as noted below
- Margins: 1 inch on all sides of 8½x11 inch paper size.
- No headers or footers.
- Avoid footnotes unless absolutely necessary.
- Page numbering bottom centered.
- No section breaks in the paper.
- No color, including url's. Format to black. No color in tables or figures. Use shading if necessary.
- All pages must be portrait orientation. Tables and figures in landscape orientations should be reformatted into portrait orientation.
- All paragraphs should be justified left and right, single spaced, in 10 point Times font, no indent on first line, l line between each heading and paragraph.
- One line between each paragraph.

Titles, Authors, and Headings:

- **Title centered 14 point bold**. One line between title and author's name.
- Authors: centered, 12 point. Name, affiliation, state, country.
- One line space to **ABSTRACT** (title 10 point, bold, all capitalized, aligned left; text of abstract 10 point, no bold)
- After **ABSTRACT**, one line space, then **Keywords**. Followed by one line space to first major heading.
- **HEADINGS, MAJOR**, 10 point, bold, all capitalized, aligned left.
  The specific headlines will be based on the content of the paper, but major sections should at a minimum include an abstract, keywords, introduction, conclusion, and references.
- **Sub-headings**: 10 point, bold, first letter capitalized, no line to following paragraph. Align left.
- *Third level headings: Italic*, 10 point, first letter capitalized, no line to following paragraph. Align left.
- **Keywords:** heading: 10 point, bold, first letter capitalized, no line to following paragraph. Align left. Your list of keywords in 10 point, no bold.

Tables, Figures and Graphs:

- All fonts 10 point.
- Numbered consecutively within each category. Table 1, Figure 1 etc.
- Title: 10 point, bold, left justify title, one space, then the table, figure, etc.
- Example: **Table 1: Statistical Analysis**

References:

- APA format when citing in the text. For example (Smith, 2009).
- References section: 8 point font, first line left margin, continuation lines 0.25 inch indent. Justify left and right. No line spacing between references. List alphabetically by first author.
- Specific references: Last name, First initial, middle initial (and additional authors same style) (year of publication in parentheses). Title of article. *Journal or source in italics.* Volume and issue, page number range.
- Example: Clon, E. and Johanson, E. (2006). Sloppy Writing and Performance in Principles of Economics. *Educational Economics*. V. 14, No. 2, pp 211-233.
- For books: last name, first initial, middle initial (and additional authors same style) (year of publication in parentheses). *Title of book in italics.* Publisher information.
- Example: Houghton, P.M, and Houghton, T.J. (2009). *APA: The Easy Way!* Flint, MI: Baker College.

Example (note that this example represents a change from previous style guides)

Evidence to Support Sloppy Writing Leads to Sloppy Thinking

Peter J. Billington, Colorado State University - Pueblo, Colorado, USA (12 point)
Terri Dactil, High Plains University, Alberta, Canada

ABSTRACT (10 point, bold, all capitalized, left justified)

(text: 10 point Times font, no indent, justified, single space, 150 words maximum for the abstract)
The classic phrase "sloppy writing leads to sloppy thinking" has been used by many to make writers develop structured and clear writing. However, although many people do believe this phrase, no one has yet been able to prove that, in fact, sloppy writing leads to sloppy thinking. In this paper, we study the causal relationship between sloppy writing and sloppy thinking.

Keywords: sloppy writing**,** sloppy thinking **(10 point, bold title, first letter capitalized, left justified).**

INTRODUCTION (10 point, bold, all capitalized, left justified).

The classic phrase "sloppy writing leads to sloppy thinking" has been used by many to make writers develop structured and clear writing. However, since many people do believe this phrase, no one has yet been able to prove that in fact, sloppy writing leads to sloppy thinking. Is it possible that sloppy writing is done, even with good thinking. Or perhaps excellent writing is developed, even with sloppy thinking.

In this paper, we study the writing of 200 students that attempts to test the theory that sloppy writing leads to sloppy thinking.

PREVIOUS RESEARCH

The original phrase came into wide use around 2005 (Clon, 2006), who observed sloppy writing in economics classes. Sloppy writing was observed in other economics classes (Druden and Ellias, 2003).

RESEARCH DESIGN

Two hundred students in two business statistics sections during one semester were given assignments to write reports on statistical sampling results. The papers were graded on a "sloppiness" factor using…

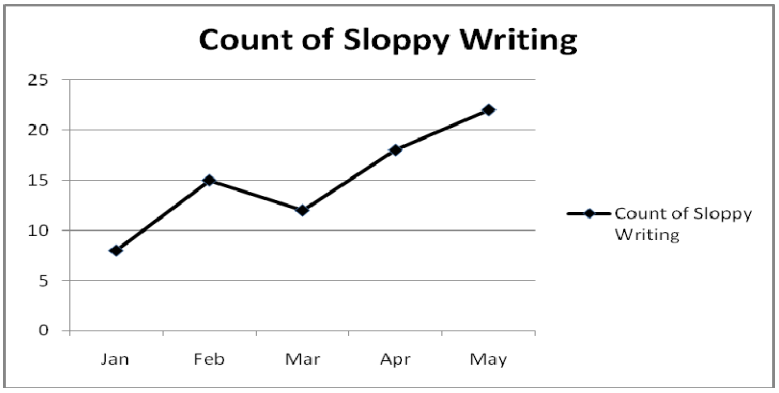
Data Collection (Sub-heading, bold but not all caps, 10 point, aligned left, bold, no line after to paragraph)
The two hundred students were asked to write 2 short papers during the semester…

Data Analysis(Sub-heading, bold but not all caps, 10 point, aligned left, bold, no line after to paragraph)
The two hundred students were asked to write 2 short papers during the semester…

DISCUSSION

The resulting statistical analysis shows a significant correlation between sloppy writing and sloppy thinking. As noted below in Figure 1, the amount of sloppy writing increases over the course of the spring semester.

Figure 1: Sloppy Writing During the Semester



The count results were compiled and shown in Table 1 below.

Table 1: Counts of Good and Sloppy Writing and Thinking (bold, 1 line after to table, left justify)

	Good Thinking	Sloppy Thinking
Good Writing	5	22
Sloppy Writing	21	36

*-Indicates significance at the 5% level)

As Table 1 shows conclusively, there is not much good writing nor good thinking going on.

CONCLUSIONS

The statistical analysis shows that there is a strong relation between sloppy writing and sloppy thinking, however, it is not clear which causes the other…

Future research will try to determine causality.

REFERENCES (title10 point, all caps, bold, align left, one line to first reference)
(1line spacing) (All references 8 point, indent second line 0.25 inch, justify left and right)

Clon, E. (2006). Sloppy Writing and Performance in Principles of Economics. *Educational Economics*. V. 14, No. 2, pp 211-233.

Devad, S. and Flotz, J. Evaluation of Factors Influencing Student Class Writing and Performance. *American Journal of Farming Economics*. V. 78, Issue 3, pp 499-502.

Druden, G. and Ellias, L. (1995). *Principles of Economics*. New York: Irwin.

(short bio section optional, can run longer than these examples; removed before sent to reviewers)

Peter J. Billington, Ph.D., is a professor of operations management at Colorado State University – Pueblo. His research interests span from lean six sigma to innovative education.

Terri Dactil, Ph.D., is a professor of business communication in the College of Business at High Plains University, Alberta, Canada. His research interests include instructional methods to improve student communication skills.

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