Vanguard University
School for Professional Studies
Degree Program

RESEARCH METHODS

BUOM # 378

Student Guide

11/07
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TEXTS AND MATERIALS

Required text:

McDaniel, C. & Gates, R. (2010). *Marketing Research Essentials (7th edition)*. John Wiley & Sons, Inc.

Recommended resources:

- Vanguard University Library Research Lab
- Various search engines and databases
- Scholarly journal articles found at large university and city libraries

COURSE DESCRIPTION

Research Methods is a course in applying research to solve business problems in the market place. The goal is to expose students to a wide range of research methods in order to equip them to meet the challenges of a fast-paced decision-making environment. Business research is a systematic inquiry, in which the objective is to employ information to solve managerial problems. The research methods class recognizes that students preparing to manage private, non-profit, and public organizations need training in a disciplined process for conducting an inquiry of a management dilemma. This course equips the manager to conduct research or manage the process of research by analysts and consultants.

CATALOG DESCRIPTION

Research Methods is a course in conducting and applying research for managerial decision-making. Problem formulation, data collection, statistical analysis and interpretation of results are covered.

LEARNING OBJECTIVES AND OUTCOMES

At the conclusion of this course students should have obtained the following:

- An enduring understanding of the research process from problem and research question identification through research design to data collection, analysis and presentation of results.
- A familiarity with writing well-developed, strategically organized business communications.
- Knowledge of the utilization of computer skills and statistical tools and techniques to conduct managerial analysis, manage information, and solve business problems.

CORE VALUES

This course supports and integrates the core values of the School of Business and Management**:**

- Integration of Faith
- Mentorship
- Academic Rigor and Substance
- Continuous Value Added Partnerships

FUNDAMENTAL SKILLS AND FOUNDATIONAL PRINCIPLES

The School of Business and Management has identified the following fundamental skills and foundational principles that are essential learning objectives for undergraduate Business majors. Fundamental skills relate to general knowledge and personal abilities that graduates will carry with them into their careers and lives. The primary fundamental skills and foundational principles for this course are shown in bold. Foundational principles require learning accomplishment in areas directly related to business disciplines, and form the core degree requirements within Vanguard's business programs.

Fundamental Skills:

- Communication Skills
- Teamwork and Project Management
- Thinking and Problem Solving
- Decision Making
- Ethical Reasoning
- Business Tools and Technology
- Change Dynamics

Foundational Principles:

- Accounting
- Management and Leadership
- Marketing
- Legal and Regulatory
- Economics
- Finance
- Global Dimensions of Business

EDUCATIONAL TARGETS AND GOALS

Educational Targets and Course Objectives for Students

Intellectual Engagement

- Acquire skills to commission the use of applied statistics to solving problems.
- Utilize research methods for the expansion of knowledge and decision making.
- Develop a basic understanding of the role of scientific research in both secular and Christian settings.

Spiritual Formation

- Gain an understanding of the role of science in the discovery of truth from a Christian perspective.
- Develop a balanced approach to decision making that adds scientific inquiry and rational judgment to biblical wisdom and metaphysical revelation.

Professional Excellence

- Learn to create/evaluate research proposals, implement research design, and critically review the finished product of a research project.
- Develop and demonstrate skills in reviewing various scholarly journals.
- Develop skills in use of providing senior management with an executive summary of professional research results.
- Gain exposure to the professional world of research analysts and academicians.
- Achieve technological competence in acquiring and processing information through statistical analysis.
- Internalize a strong sense of ethics in research

Socio-cultural Responsiveness

- Participate in class discussion and exercises to increase awareness of the research process.
- Articulate a growing understanding of the role of scientific research in achieving organizational objectives.
- Know the language of science and intelligently assess the research of secular and Christian researchers in pursuit of evidence for conflicting presuppositions.

Responsible Stewardship

- Learn the research process for an organization, which can further its growth and help it achieve future success.

OVERVIEW

What is this class about?

Many students entering Research Methods are unsure about what to expect. This class may be the business student's first exposure to the quantitative side of management. This class is primarily about the process and the tools of business research needed to minimize the risks associated with managerial decision-making. This course involves hands-on practice with research methods as well as practice with statistics.

What is research?

Research is defined as a ''systematic inquiry aimed at providing information to solve managerial problems.'' The term 'systematic inquiry' refers to research as being 'systematic' as distinct from a process of 'chance' or 'fortuitous' discovery. The term systematic can also be related to the scientific method, the idea being that research is the process of inquiry conducted in the best, or at least, most appropriate way. However, the concept of systematic inquiry is wide enough to encompass different approaches to conducting research and does not restrict the scope of research to a particular methodological paradigm. It includes descriptive research, and does not restrict research to studies which are "guided by theory and hypotheses about presumed relations." Distinctions can be made between applied and pure research, but both are research.

Applied research starts with a practical, problem-solving focus. A particular management decision must be made, and applied research involves collecting information specific to that manager's decision. Pure research is involved with collecting information that might be used by a variety of managers. It strives to answer the broader "what if…" question. Applied research might ask 'Should we institute a commission compensation system for my company's sales personnel?' Where pure research would ask: 'If an aggressive sales approach is desired, what percent of compensation should be based on commission and what percent on salary? If a high level of post-sale customer service is desired, what percent of compensation should be based on commission and what percent on salary?'

How much statistics is in the course?

The rigor of statistics in the textbook ranges from elementary to intermediate, but the level of the statistics in this course does not go beyond elementary. In recognition of the likelihood that students will encounter statistical content in their careers, rather than engineer statistical results, the course emphasizes the interpretation of statistics over calculation. However, some of the assignments do require calculation as a means to understanding statistical presentation.

How is the course material structured throughout the weeks?

Students may be approaching this course with limited knowledge of its content. It is helpful to get a big picture of how the course progresses. It is divided into three parts:

Part 1: Introduction to Research

Week 1: The first week is an introduction to what the research process is, why it is important in business, the value of secondary data, and the role of databases. The student is also introduced to the concept of measurement along with questionnaire design and the role of the questionnaire in the research process (to facilitate an effective start to the group survey research project).

Part 2: Data Collection

Week 2: The second week discusses the difference between qualitative and quantitative data and different methods of conducting qualitative research. A specific focus is placed on survey research.

Week 3: Primary data is also collected through observation and experimentation. This week explores both methods including experimental setting, notation, design, and test markets. The use of the internet in data collection is also discussed.

Part 3: Data Analysis

Week 4: Students explore the issues associated with basic sampling and then delve deeper into sample size determination. The Data Analysis portion of this class begins with an in-depth look into the five steps of the data analysis procedure. The topics of descriptive statistics, a way to succinctly describe a set of data; and hypothesis testing, a study of the likelihood that the data supports the claims of the researcher, using statistical methods, are both discussed. Students also explore graphical methods to probe data for meaning.

Week 5: The last class completes the topic of Data Analysis and looks at ways to evaluate the relationship between two variables. Also included is a discussion on how to present the analysis to a target audience and the ethical issues researchers face. Student project presentations are scheduled for week 5.

How will each class be structured?

The student will engage in Research Methods through conceptualization, discovery and application. This means that every topic will have a didactic portion followed by activities and/or class discussion.

COURSE POLICIES

- **ATTENDANCE AND TARDY POLICY**

  You must attend class on time and remain present until dismissed. Class attendance is necessary in order to complete the course. This course relies on the dynamics of class interaction and group processing in order to integrate and apply the learning of academic content. This model also emphasizes the development and practice of interpersonal communication skills and teamwork (e.g., group problem solving and negotiation). The format therefore necessitates class attendance. In practical terms, one course session is equivalent to three weeks of traditional semester course work.

  > *Students who miss more than one class meeting (or more than five class hours) in any given course will automatically receive a failing grade and need to retake the course to obtain a passing grade. If an instructor deems that a student's second absence was under extremely unavoidable and unusual circumstances (i.e., an auto accident), the professor may file an academic petition on behalf of the student to the Director of SPS. If the academic petition is approved, the student will be given a "W" (Withdrawal) in place of a failing grade. The student will still be required to retake the course.*

  Students who arrive late disturb the class. At the professor's discretion, students who arrive late may not receive participation points for the unit covered. Students who are habitually late may be asked to drop the course.

- **CLASS PARTICIPATION**

  You must be prepared and participate in all discussions. Criterion: Is the student engaged in classroom discussions? Does the student demonstrate an ability to handle assigned material with a degree of proficiency? (E.g., demonstrate the type of questions and issues consistent, and reflecting a familiarity with the assigned material). Participation evaluated according to quality, not quantity, of participation. Attendance will be scored, and no participation points will be awarded if the student is absent.

- **LATE PAPER POLICY**

  You are responsible for submitting assignments on time. Unless otherwise noted by the Instructor, all assignments are due by 6 p.m. on the date indicated in the curriculum guide.

- **ACADEMIC DISHONESTY**

  Work submitted for assessment purposes must be the independent work of the student concerned. Plagiarism, or copying and use of another's work without proper acknowledgment, is not permitted. Nor is it permissible for any former or present student to allow another student to refer to, use as a sample, or in any way copy or review their work. If a student needs guidance, he or she must seek the Professor's assistance.

- **DISABILITY SERVICES**

For students with documented medical or psychological disabilities, please contact the Coordinator of Disability Services to request reasonable accommodations. The Coordinator of Disability Services is located in the Counseling Center on the second floor of the Scott Academic Center and can be reached at extension 4489 or by email at disabilityservices@vanguard.edu

For students with a documented learning disability who would like to request appropriate accommodations, please contact the Director of Learning Skills, located upstairs in Scott Academic Center at extension 2540 or by email at disabilityservices@vanguard.edu

SPECIFIC FEATURES AND CONTENT

1. **Introduction to Research**
   - The role of research
   - Research and decision making
   - Applied vs. pure research
   - Problem definition and the research process
   - Measurement
   - Questionnaire design

2. **Data Collection Part 1**
   - Secondary data
   - Databases and data mining
   - Qualitative research
   - Survey research

3. **Data Collection Part 2**
   - Online research
   - Primary data - observation
   - Primary data - experimentation

4. **Data Analysis Part 1**
   - Basic Sampling
   - Sample size determination
   - Collecting data through experimentation
   - Data processing
   - Statistical testing of differences
   - Descriptive statistical summaries
   - Hypothesis testing
   - Statistics graphics

5. **Data Analysis Part 2**
   - Bivariate regression and correlation analysis
   - The research report
   - The presentation of results in oral and written reports
   - Managing research ethics

STUDENT ASSIGNMENTS

WEEK ONE

- Read text chapters 1, 2 9, 10 including Appendices
- Nothing written due the first week of class

WEEK TWO

- Read text chapters 3, 4, and 5
- Due at the beginning of class: Assignment #2 (Provided by Instructor)

WEEK THREE

- Read text chapters 6, 7, and 8
- Due at the beginning of class: Assignment #3 (Provided by Instructor)
- Due: Academic Review

WEEK FOUR

- Read text chapters 11, 12, and 13.
- Due at the beginning of class: Assignment #4 (Provided by Instructor)

WEEK FIVE

- Read text chapters 14, and 15
- Due at the beginning of class: Assignment #5 (Provided by Instructor)
- Due: Survey Project and Presentation

STUDENT EVALUATION

Attendance & Participation	10%
Text Assignment Weeks 2-5	20%
Quizzes Weeks 2-5	20%
Academic Review Week 3	15%
Survey Project Oral Presentation	15%
Survey Project Written Paper	15%
Individual Grade	5%
Total	100%

GRADING SCALE

Percentages	Grade	Significance	GPA
93-100%	A	Exceptional	4.00
90-92.9%	A-		3.67
87-89.9%	B+		3.33
83-86.9%	B	Above Average	3.00
80-82.9%	B-		2.67
77-79.9%	C+		2.33
73-76.9%	C	Average	2.00
70-72.9%	C-		1.67
67-69.9%	D+		1.33
63-66.9%	D	Below Average	1.00
60-62.9%	D-		0.67
00-59.9%	F	Failure	0.00

LOGISTICS CHART

Hour	Week 1	Week 2	Week 3	Week 4	Week 5
1	Introduction Ch. 1	Review HW Quiz wk 2 Ch. 3 Activity	Review HW Quiz wk 3 Ch. 6 Activity	Review HW Quiz wk 4 Ch. 11 Activity	Review HW Quiz wk 5 Ch. 14 Activity
2	Ch. 2 & Activity	Ch. 4 & Activity	Ch. 7 & Activity	Ch. 12 & Activity	Ch. 15 & Activity
	Break	Break	Break	Break	Break
3	Ch. 9 & Activity	Group Project Time Ch. 5 & Activity	Group Project Time Ch. 8 & Activity	Group Project Time Stats Lesson Activity	Survey Project Presentations
4	Ch. 10 & Activity Group Project Time	Library Visit to Prep for Academic Review	Academic Review Discussion	Ch. 13 Activity	Survey Project Presentations

WEEK ONE

Introduction to Research

Assignments Due

- Read chapters 1, 2, 9, and 10 including Appendices
- Nothing written due the first week of class

TOPICS

- The role of research
- Research and decision making
- Applied vs. pure research
- Problem definition and the research process
- Measurement
- Questionnaire design

Instructor will review with students the specifics of the Survey Project and Presentation (detailed on the next three pages.) This project is due week 5 but will be developed over the course of the next four weeks.

Survey Project and Presentation - Due Week 5

You are asked to follow the research process outlined in your text to identify a research problem/opportunity and research objective, develop a research questionnaire, determine your population of interest and survey sample, pre-test the questionnaire and then conduct a survey using the questionnaire, tabulate the results applying statistical concepts, put your findings in a written document and present the project and its results to the class in an oral presentation on Week 5. A sample paper, survey, and power point presentation is included at the end of this guide.

Written Report: Each student group will submit a 1300-1500+ word paper covering the sections noted below. The format will be: single spaced within paragraphs and double-spaced between paragraphs and sections, 10 to 12 point type, 1 inch margins, Times Roman font.

I. **Problem/Opportunity.** Find a management dilemma/problem/opportunity that would benefit from the results of survey data. Describe the dilemma/opportunity, how you identified it, and what your resulting research objective is (reference the steps in identifying the research problem and objective as outlined in your text.)

II. **Research Design & Method.** Design a survey (addressing the dilemma/opportunity) of approximately 10 questions. Use a variety of question types and rating scales as discussed in chapters 9 & 10 of your text. Pre-test your questionnaire and make necessary revisions before beginning your pilot survey. Discuss the survey and the rationale behind the questions and rating scales chosen. Discuss what you learned from pre-testing the survey and what changes you made based on the pretest. Include the questionnaire as an attachment to your paper. State your hypothesis (or hypotheses, if more than one.)

III. **Sampling Procedure**. Determine your population of interest, your sample frame, and the type of sample you will use. Discuss your method of developing your sample and the process you used to find and survey your respondents. Get at least 20 real respondents for your pilot survey. Discuss how you might have ensured that your respondents were randomly selected (though it may not have been feasible for you to actually implement a random selection) and how you would have gone about the selection if it were possible.

IV. **Findings**. Include the results of your survey in written/prose form – with appropriate discussion and with relevant charts, graphs, and spreadsheets to provide pictorial representation of key findings. Insert the relevant charts and graphs in the appropriate paragraph of this Findings section and in appendices as needed. Calculate the basic descriptive statistics, as appropriate, for the data (mean, median, mode, and standard deviation.)

V. **Conclusions and Recommendations**. Analyze the findings and draw conclusions/key insights from the findings of the pilot survey (as if it was a final survey.) Discuss the key insights/conclusions drawn from this analysis. Note whether or not the research objective(s) was met (tie the conclusions back to the hypothesis) and state

recommendations as based on the research. Include any additional charts/graphs (not embedded in the document) as attachments. Note: all charts/graphs/tables, whether included as attachments to the paper or included within the document, should be referenced in the write-up. (Be clear on the differences between findings, conclusions, and recommendations.)

VI. **Flaws in the Research Design**. Discuss any flaws in the research design or process that you uncovered as you completed your research. Note how these flaws may have impacted the research findings and conclusions. Note any changes you would make were you to do this again. Be specific, include specific questions you would omit or revise in the survey and how you would revise them.

VII. **Ethical Issues** Review Appendix 1-B of the text and discuss any ethical issues associated with your survey project.

VIII. **Presentation Handouts** Include a copy of your oral presentation slides – in handout form at 4-6 slides per page – at the end of your written report.

Oral Presentation. Prepare an oral presentation (30 – 45 minutes total including questions and class discussion) supported by a power point slide show to share your research and results with the class on Week 5. Include the survey in the presentation and bring one copy of the survey with no names on it to the Week 5 class. Engage the class in discussion as you present. All group members should participate in the oral presentation and class discussion.

See **Project Timeline** on next page.

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Survey Project Timeline

Week 1	Between 1-2	Week 2	Between 2-3	Week 3	Between 3-4	Week 4	Between 4-5	Week 5
Form groups	Each person write 3-5 questions for survey and bring to class on week 2	Finalize survey questions Write Research Question in one sentence	Format survey and approve via email for printing Pre-test survey & revise	Bring survey results to class	Complete surveys	Work on key elements of report	Complete written report	Project presentation
Determine survey focus		Assign person to format survey	Disseminate survey and begin conducting surveys	Discuss analysis of results	Complete analysis of results	Work on key elements of ppt	Complete ppt	Submit written document
Write Problem Opportunity statement		Determine population of interest and sample frame	Begin analysis of results	Brainstorm and write key points gleaned from data	Create ppt design			Submit handouts of oral presentation
Brainstorm types of data, information needed to address prob/opp		Determine who/how oral presentation and written document will be done		Write Sections I-III of the written report				Email oral presentation to instructor

WEEK TWO

Data Collection Part 1

Assignments Due:

- Read text chapters 3, 4, and 5.
- Due at the beginning of class: Assignment #2 (Provided by Instructor)
- Prepare for in-class quiz week 2 covering chapters 1, 2, 9, and 10

TOPICS

- Secondary data
- Databases and data mining
- Qualitative research
- Survey research

ACADEMIC REVIEW

Please select a peer-reviewed journal (you may consider using one of the journals listed below) and find an article of interest to you (the article must be full-text, not an abstract.) The article should be no more than 5 years old. Choose one that has sufficient content so that you can write a report similar in style to the sample included at the end of this guide.

The object of your critique is to describe how the study followed or failed to follow the criteria for good research. Speculate on which of the writer's conclusions were warranted and which were not.

Samples of acceptable Journals	ISSN #
Academy of Management Review	03637425
Administrative Science Quarterly	00018392
American Journal of Small Business	03639428
Business and Society Review	00453609
Business Economics	0007666 x
California Management Review	00081256
Financial Management	00463892
Industrial and Labor Relations Review	0019739
Journal of Accountancy	00218448
Journal of Advertising Research	00218499
Journal of Industrial Economics	00221821
Journal of Marketing	00222429
Journal of Marketing Research	00222437
Journal of Retailing	00224359
Sloan Management Review	0019848 x
Journal of Consumer Research	00935301

Submit a hard copy in class. Please attach a hard copy of the journal article to your paper.
The review should be 1300-1500+ words, single-spaced within sections, double-spaced between sections. Use Times New Roman 12 point font and 1 inch margins.
Format headings for the Academic Review:

I. **Overview** – summary of the key points
II. **Research Problem** - what issue is being addressed, include the research objectives/hypotheses
III. **Research Design and Procedures** - what, specifically, was done
IV. **Findings/Analysis of Data** - summary of researcher's analysis in addition to your assessment of the data
V. **Flaws in Analysis/Design** – identify limitations noted in addition to your assessment of flaws
VI. **Research Conclusions and Recommendations** - include the applicability of the findings
VII. **Researcher's Reputation** - this may require you to investigate the researcher to obtain information beyond what is listed in the document

WEEK THREE

Data Collection Part 2

Assignments Due

- Read text chapters 6, 7, and 8
- Due at the beginning of class: Assignment #3 (Provided by Instructor)
- Due at the beginning of class: Academic Review
- Prepare for in-class quiz week 3 covering chapters 3-5

TOPICS

- Online research
- Primary data - observation
- Primary data - experimentation

WEEK FOUR

Data Analysis Part 1

Assignments Due

- Read text chapters 11, 12, and 13.
- Due at the beginning of class: Assignment #4 (Provided by Instructor)
- Prepare for in-class quiz week 4 covering chapters 6-8

TOPICS

- Basic Sampling
- Sample size determination
- Collecting data through experimentation
- Data processing
- Statistical testing of differences
- Descriptive statistical summaries
- Hypothesis testing
- Statistics graphics

WEEK FIVE

Data Analysis Part 2

Assignments Due

- Read text chapters 14 and 15.
- Due at the beginning of class: Assignment #5 (Provided by Instructor)
- Due: Survey Project and Presentation
- Prepare for in-class quiz week 5 covering chapters 11-13

TOPICS

- Bivariate regression and correlation analysis
- The research report
- The presentation of results in oral and written reports
- Managing research ethics

Student Samples of a written Survey Project and Academic Review begin on this page.

Marketing Survey Project

Flashlight Specifications for Law Enforcement

Research Methods BUOM 378

Professor ____

Date ____

SURVEY WRITTEN REPORT SAMPLE

Flashlight Specifications for Law Enforcement

Research Problem and Opportunity

History

When the general public thinks of tactical tools commonly used by law enforcement, one item is typically overlooked. The flashlight is a tool which bears an enormous amount of significance for officers throughout the world. It is so important that officers carry one, regardless of whether they are working in day or night conditions. In fact, southern California law enforcement officers hold their flashlights in such regard that one would be hard pressed to start a shift without this light source. Overall, the flashlight is one of the most frequently used tactical tools in the officer's repertoire.

Objective

We chose to research these tactical tools because of the benefits they provide and the importance of manufacturing a well suited tool in the law enforcement market. Officers rely heavily on their flashlights and the fact there are many different variations on the market, we chose to find a common package setup which officers prefer. We felt a survey would be a sufficient method of data collection. Our objective was to identify what common components officers liked in a flashlight and what they did not. We also sought officers' suggestions for primary data information related to new components and/or configurations. Considering the significance of the officer's flashlight, it is a relatively simple device. Over the years, manufacturers have adjusted or reconfigured the body composition, length, battery type, bulb type, and switch location. These marketing mix modifications have followed manufactures research, including surveys in the target market. Many products have come and gone because they have been inadequate in their design makeup. Lastly, we wanted educate officers regarding the flashlight technology available to them.

Flashlight Usage

In contrast to the many different configurations and large number of models on the market, the flashlight holds two primary purposes. First and foremost, the flashlight is an illumination device. There are countless situations in which officers are confronted with low light scenarios. The use of a flashlight can make the difference between life and death. In one regard, the flashlight can illuminate a suspect or dangerous situation, on the other hand, the flashlight locate a missing piece of evidence.

A second and lesser known use of the flashlight is that of an impact weapon. As one can imagine, each police department has their own use of force policy. Today's officers are equipped with a variety of impact weapons. Due to its frequency of use and the fact that it typically occupies an officer's hand, the flashlight can be a readily available option. However, it must be mentioned that the flashlight is not a recommended impact weapon. This device is used when an officer is immediately confronted and in situations where it is a last resort option.

As with any piece of equipment in the officer's arsenal, there are numerous design preferences for flashlights which correlate with the intended environment. For example, based on past preference, patrol officers typically desire a brighter, more durable, and longer running flashlight. Whereas, nighttime traffic officers who use a light more frequently during stops, prefer a lighter weight, longer running flashlight.

Research Design and Method

Since law enforcement officers are one of the largest flashlight user populations, we chose to focus on this group for our sample frame analysis. Specifically, we decided to sample law enforcement officers at three different police departments, Costa Mesa Police Department, Los Angeles Police Department, and Newport Beach Police Department.

Upon identifying the law enforcement flashlight as our area of research, we put together a list of configurations and options that are currently available through manufacturers. Typically, officers carry a small flashlight on their duty belt and larger flashlight for general purpose illumination. Due to the fact the belt lights are smaller and used with less frequency, we chose to focus on the larger, more frequently used lights. We recognized this by making the distinction in the cover instructions for our survey.

In constructing our survey, our goal was to put together a complete measurement tool, without requiring a significant amount of time for completion. We felt respondent information related to experience, assignment, and current flashlight usage, provided background and sample identification for screening purposes. We also chose several types of questions so we would have format diversity, so as to maintain respondent interest. In addition, our goal in formulating various types of questions for the survey was to avoid measurement instrument bias. We designed questions that would assist us in collecting pertinent data for supporting our hypothesis. In this particular area, the format was inspired by an in-depth understanding of the products and the target environment. In the end, we produced a survey we felt measured consistent results (reliability) and appropriate results (validity). At the conclusion, respondents were asked an open ended question seeking their opinion regarding a flashlight manufacturing suggestion. We received some very interesting answers.

In constructing the pre-test, we assessed the survey sheet utilizing face validity. We felt based on our understanding; we had a sound measuring instrument. However, during our pre-test deployment, we found areas that required modification. For example, we added an open ended question to the end of our survey, we did not distinguish between day or night use, and we increased the assignment section from an officer's division, to his/her assignment.

Reflective of the target population and market options, we concluded the following hypothesis;
H_1: *That all law enforcement, regardless of city or assignment, will prefer the following features:*

- Light type: LED Halogen
- Flashlight length: 3 cell, or under 12 ½"
- Switch location:
  - Base – 4
  - Side – 3
  - Dual – 1
- Run time: 3 hours
- Battery type: Lithium-Ion

Priorities:

1st Candlepower
2nd Runtime
3rd Switch Location
4th Light Type
5th Length
6th Battery Type

Sampling Procedures

Population of Interest

For this survey, the researchers chose all Law Enforcement as the population of interest. This was due to their extensive use of flashlights during both day and night conditions. Law Enforcement personnel often carry (or have readily available) multiple flashlights.

The researchers decided to use independent samples so subjects could not influence each others decisions. Non-probability samples were selected due to convenience and cost. Officers from researcher's own departments were used to obtain judgment samples. The researchers chose officers whom they deemed representative of all law enforcement officers.

Method of developing sample

A Non-probability (Judgment Sample) was selected by the researchers for this survey. Three representatives of law enforcement were among the researchers. Each representative disseminated surveys at his respective agency. These surveys were loosely tracked in an attempt to distribute them equally at each agency. Some of the surveys were handed out while others were sent to respondents via email.

Process used to find/survey respondents

The respondents were specifically selected from the researchers own departments. This was done for convenience.

Findings

Thirty-four law enforcement officers responded to the *Flashlight Features Survey* that our team created and distributed. The respondents had the option of completing the survey online or hardcopy (pen & paper). The respondent's method of completing the survey was roughly balanced at fifty-six percent preferring online, and forty-four percent preferring hardcopy.

Demographics

The demographics of the respondents are representative of local law enforcement. The variety of assignments that each law enforcement officer holds is proportionate between detective, patrol, traffic, and administration. The majority of the respondents work as Traffic officers (≈27percentage). Patrol officers are the second highest category (≈24percentage).

Detective and Administration have an equal number of respondents (≈21percentage). Finally, the balance of the respondents works in other divisions, including vice, instruction, and juvenile court (≈9percentage). The researchers polled three local organizations: Costa Mesa, Newport Beach, and Los Angeles. The respondents are well balanced between the three cities; Costa Mesa represents ≈38percentage of the respondents, while Newport Beach and Los Angeles both represent ≈29percentage of the respondents. One response came from Apple Valley making up the balance of the subjects (≈5percentage). The final question regarding demographics focuses on how long each respondent has been in law enforcement. The answers cover a wide range of years with the minimum number of years in service being three, and the maximum number of years in service being thirty; the mean number of years served is thirteen point one.

Current Equipment Evaluation

The survey asked respondents to evaluate his or her current flashlight in the following areas: *usage, light type, length, candlepower, and run time*. The first question, regarding *usage*, revealed that ninety-one percent of all respondents use his or her flashlight less than three hours per shift. The results of the *usage* question are in direct opposition to responses to the question related to *prioritization*, which ranked *run time* as the second most important characteristic of a flashlight. The characteristics of *light type, length, candlepower, and run time* were generally represented by the mean of their combined scores. Seventy-three percent of respondents were either satisfied or extremely satisfied with his or her current flashlight; while only ten percent were dissatisfied or extremely dissatisfied with his or her current flashlight. Interestingly, two of the four respondents that rated his or her flashlight lowly were the same in all four categories; this may indicate a general bias against the flashlight without regard to the individual characteristics. If those two respondents were removed from the survey, then the number of satisfied respondents jumps to seventy-seven percent.

Flashlight Components

The survey asked detailed questions about particular flashlight features. The four features covered in this section were *light type, length, switch location, and battery type*. In the *light type* category, Halogen light was preferred over all other light types (≈40percentage), while LED and combo Halogen / LED were roughly equal (≈25percentage). Manufacturers of flashlights should note that by utilizing the combo Halogen / LED light type, they would satisfy ninety-one percent of market demand.

The second feature covered was *length*. Seventy-seven percent of respondents preferred a flashlight that was between seven inches and twelve and a half inches long. The third feature covered was *switch location*; with the options presented in the survey were base switch, side/body switch, or dual switch. This feature epitomizes the diversity in personal preference between law enforcement officers. Approximately twenty-five percent of the respondents were neutral regarding the location of the switch. The strongest preference was for the side / body switch, but it garnered just over fifty percent of respondents. Compared with such strong proportions as ninety-one percent in *light* type and seventy-seven percent in length, fifty percent is not a decisive indication of law enforcement preference. The final feature covered in this section of the survey was *battery type*. This feature, like *switch location*, demonstrates the diversity of opinion on the best components of a flashlight. The respondents were roughly split between Lithium-Ion and Nickel-Cadmium (NiCad) batteries with about seventeen percent of respondents indicating "no preference" on *battery type*.

Finally, respondents were asked to prioritize the features of the flashlight. The six components that he or she needed to prioritize were *light type, length, switch location, candlepower, run time,* and *battery type.* The component with the highest percentage of selections for importance was C*andlepower* with eighty-three percent of the respondents putting it as priority one or two; of that number, fifty-three percent had it as the most important. The second most important component *Run Time,* had a fifty-nine percent priority rating, with thirty-two percent of the respondents responding it as priority one. Fifty-three percent of the respondents put *Switch Location* as a priority rating of three or four overall, with thirty-two of that fifty-three percent rating it as a three in level of importance. The *Length* of the flashlight scored fourth in priorities with twenty-nine percent putting it third and thirty-two percent of respondents placing it fourth. *Light Type* was rated fifth by forty-one of the respondents. *Battery Type* was the least important component to the respondents, with a significant fifty-six percent voting it last.

Open-ended Question

The survey contained one open-ended question that read, "If you could be a manufacturer for a day, what one item would you add to a new flashlight?" Three respondents focused on candlepower, battery life, weight, and toughness. It is interesting to note that even though twenty-two out of thirty-four people were satisfied or extremely satisfied with the run time (battery life) of his or her flashlight, there is a need for further investigation. The other reoccurring replies were water resistant, textured grip for better handling, and some sort of stand for fixed use.

Research Conclusions and Recommendations

We, the researchers, hypothesized law enforcement officers' preferences his or her flashlight in several different aspects.

Researchers predicted that officers would prefer to have combination LED / halogen bulbs. Ninety percent of the respondents chose halogen, LED or a combination of halogen and LED for his or her flashlight.

Researchers predicted that the length of the flashlight the respondents would want was ten to twelve and a half inches long; forty-one percent of the respondents chose the answer "…under 12.5 inches", with seventy-seven percent respondents preferring a light between seven and twelve and a half inches in length.

There were three options on a flashlight for the switch, on the side, on the base, or a switch on the side and on the base. Researchers hypothesized that the most preferred location would be on the base, next would be on the side, then both locations. The results were not definitive to this question. The answers were varied, with all three scoring high; some of the questionnaires did not have answers for this segment. These two factors lead the researchers to believe that the respondents did not understand this block of questions.

Researchers predicted that officers would prefer to have lithium ion batteries. Forty-five percent of the respondents chose lithium ion as the preferred battery. The next most popular battery chosen was nickel-cadmium at thirty-five percent.

Researchers predicted that officers would prefer to have a run time of three hours. The question was deemed invalid by the researchers due to the wide range of answers; responses ranged from one hour to forty-eight hours. The spread of answers demonstrated to the researchers that the question was badly structured and the respondents did not understand it.
Researchers asked the respondents to prioritize six features of the flashlight, from one to six with one being the most important and six the least. Researchers hypothesized the following order from most important to least:
1-Candlepower
2-Run time
3-Switch location
4-Light type
5-Length
6-Battery type

The results showed the following order of importance:
1-Candlepower
2-Run time
3-Switch location
4-Length
5-Light type
6-Battery type

Researchers were not correct in the importance of light type and length only. Overall, the researchers were accurate in their hypothesis.

Recommendations

Researchers feel that the objectives were met. Data was collected that shows what officers find important in their flashlights, and how important different features of a flashlight are to officers.

Further research needs to be conducted into the amount of run time officers' desire from their flashlights. The question on this survey was not worded in such a way as to be understood by the respondents, and was there for removed from the analysis of the results.

More investigation needs to be conducted on the location of the switch that is preferred by officers. This survey was not able to capture that data.

This research was conducted on only a small portion of local law enforcement. The number and scope of the research needs to be expanded to get a better cross section of the target population.

Flaws in Research Design

Some flaws to this research should be noted. First, the researchers solicited respondents from only three police agencies. Of these agencies, the majority of respondents worked in the detective division. The various assignments within law enforcement use flashlights on different levels. Some assignments call for the officer to have a greater, more frequent, need to use a flashlight than others. This could greatly affect the data collected. Ideally, additional data could be obtained if state and federal agencies were included in the survey. Also, if an equal amount of personnel in each specific assignment were surveyed.

Next, after reviewing the data collected, we found that one of the survey questions was invalid. The question asked; What is your minimum requirement, in **hours,** for flashlight run time? Answers to this question varied from one hour to 24 hours. This indicated to the researchers that the question was misinterpreted by some of the respondents. The researchers determined some respondents answered the question as to consecutive run time (flashlight constantly running before completely loosing charge). It appeared that other respondents answered the question as to how many hours the flashlight could be used intermittently prior to loosing charge.
Law Enforcement Officers usually operate their flashlights for short durations numerous times during the course of their shift. In most cases under normal condition, a flashlight with a fresh charge and good battery should last the officer the entire shift.

Ethical Issues

This section is not covered in this sample report (not required at the time written). For this section, students should review Appendix 1-B of the text and cover key issues in research ethics as they apply to the survey research conducted.

Flashlight Specifications for Law Enforcement Questionnaire

Hello Fellow Officers -

We invite you to participate in our **Flashlight Features Survey**. Approximately 50 Law Enforcement personnel will be asked to complete this survey. The questions pertain to flashlight features, and your approximation of their relative value. It will take approximately 15 minutes to complete the questionnaire.

Your participation in this study is voluntary. There are no foreseeable risks associated with this project. However, if you feel uncomfortable answering any questions, you can withdraw from the survey at any point. It is very important for us to learn your opinions.

Your survey responses will be strictly confidential and data from this research will be utilized only in an academic environment. Please answer these questions based on your experience. For each question, choose the answer that most closely represents your opinion.

The **Flashlight Feature Survey** is broken into three sections.

Section 1 consists of a few questions about your role within the police force, and your opinion of the flashlight you are currently using.
Section 2 contains comparisons of different flashlight features, such as type of light, size, etc.
Section 3 has one question that asks you to rank the importance of each feature listed in relationship to the other features.

Please focus on your large flashlight, rather than on your small flashlight (palm size lights), when answering all the questions.

If you have any questions, please contact the officer who forwarded this questionnaire to you.

Thank you very much for your time and support. Please start the survey now by going to the next page.

Flashlight Specifications for Law Enforcement Questionnaire

SECTION 1:

Current Assignment

Please answer the following questions about your current job in the space provided.

For which **city** do you work?

How many **years** have you been a law enforcement officer?

What is the **make** and **model** of the large flashlight you currently use?

Assignment

Please select the assignment that closely relates to your current assignment. Circle the appropriate response.

1. Patrol
2. Traffic
3. Detective
4. Administration
5. Other _____

Flashlight Specifications for Law Enforcement Questionnaire

Flashlight Usage

Please select the answer that most closely matches the amount of time you **typically use** your flashlight during a **shift**. Circle the appropriate response.

1. Less than 1 hr
2. 1 to 3 hrs
3. 3 to 7 hrs
4. More than 7 hrs

Current Flashlight Evaluation

Please evaluate the flashlight you are currently using on the job. Check the appropriate boxes.

	Extremely Dissatisfied	Dissatisfied	Neutral	Satisfied	Extremely Satisfied
Light Type	❑	❑	❑	❑	❑
Length	❑	❑	❑	❑	❑
Candlepower	❑	❑	❑	❑	❑
Run Time	❑	❑	❑	❑	❑

SECTION 2:

Light Type

From the list below, please pick the light type that you prefer. Circle the appropriate response.

1. LED
2. HALOGEN
3. XENON
4. Combo: LED & HALOGEN
5. Combo: LED & XENON
6. Other _____

Flashlight Specifications for Law Enforcement Questionnaire

Length

From the list below, please select the flashlight length you prefer. Circle the appropriate response.

1. 1 cell or under 7”
2. 2 cell or under 10”
3. 3 cell or under 12 ½”
4. 4 cell or under 14 ½”
5. 5+ cell or Over 14 ½”
6. Other _____

Switch Location

Below is a list of switch locations on a flashlight. How important is each switch placement to you?
Check the appropriate boxes.

	1 Not Important	2	3	4	5 Very Important
Base or Bottom Switch Control	❑	❑	❑	❑	❑
Side or Body Switch Control	❑	❑	❑	❑	❑
Dual Switch Control (Bottom & Body)	❑	❑	❑	❑	❑

Run Time

What is your minimum requirement, in **hours**, for flashlight run time? Please use the space provided.

Battery Type

Please select the battery type you prefer. Circle the appropriate response.

1. Lithium-Ion
2. Nickel-Cadmium (NiCad)
3. Alkaline
4. CR123 Lithium
5. No Preference
6. Other _____

Flashlight Specifications for Law Enforcement Questionnaire

SECTION 3:

Prioritize Flashlight Features

Please rank the following flashlight features in the order of importance to you. **1** is the **most** important feature and **6** is the **least** important feature.

- Light Type _____
- Length _____
- Switch Location _____
- Candlepower _____
- Run Time _____
- Battery Type _____

Comments

Please use the space provided to answer questions.

If you could be manufacturer for a day, what one item would you add to a new flashlight product?

Comments:

Thank you for participating in our survey.

Please return the survey to the officer who gave it to you

Flashlight Specifications for Law Enforcement

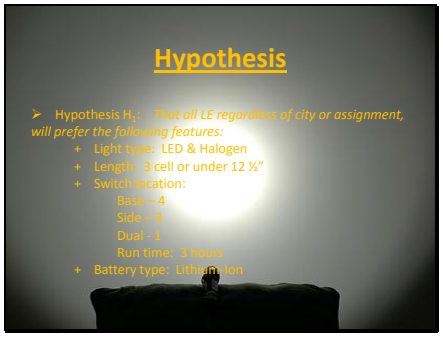
Power Point Presentation

Slide 1

Slide 2

Slide 3

Slide 4



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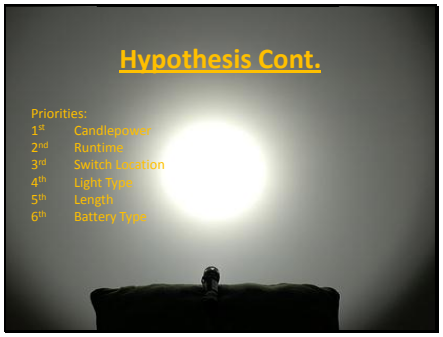

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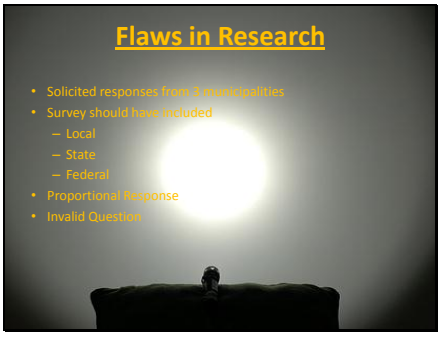

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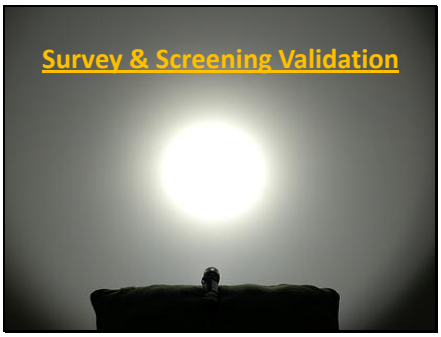

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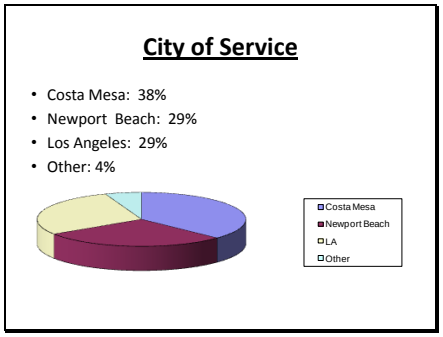

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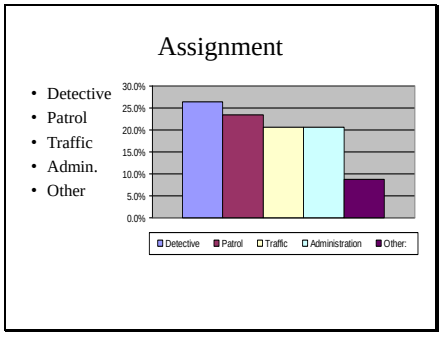

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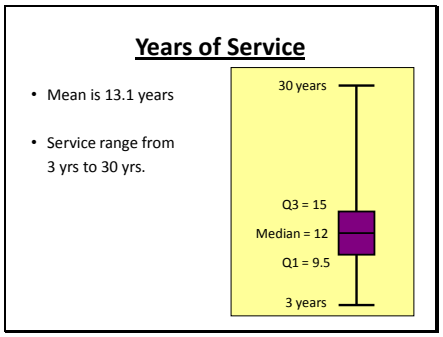

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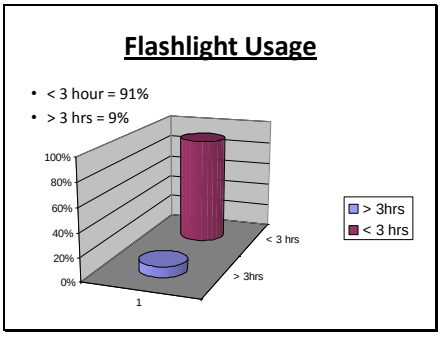

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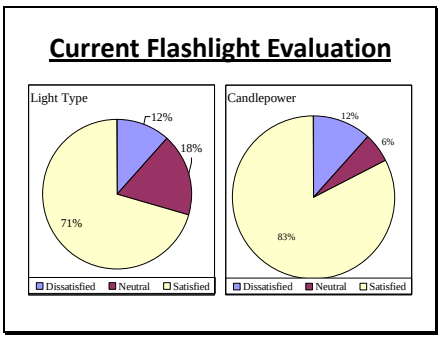

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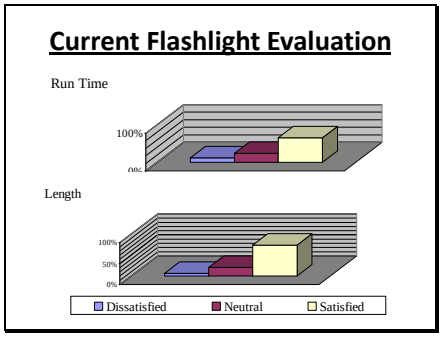

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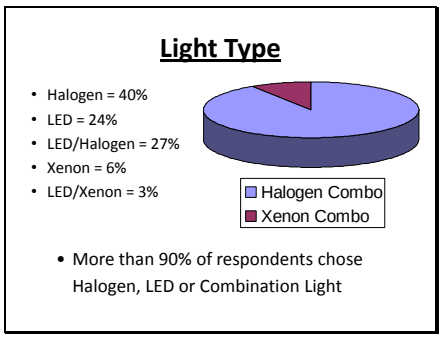

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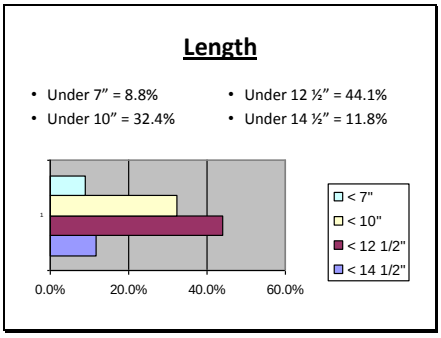

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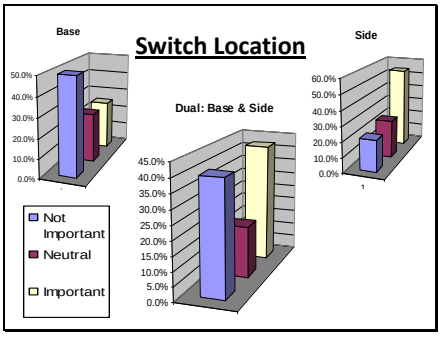

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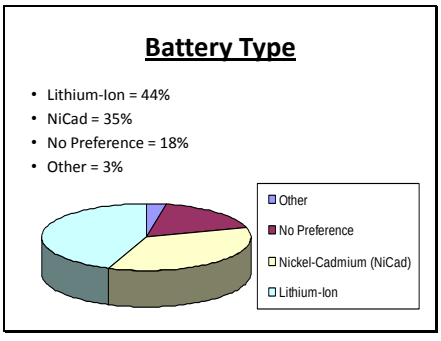

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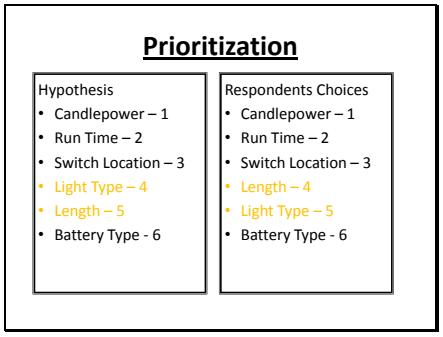

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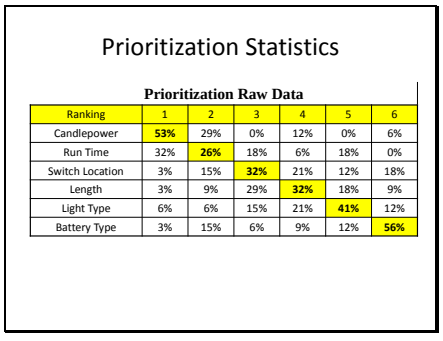

Ranking	1	2	3	4	5	6
Candlepower	53%	29%	0%	12%	0%	6%
Run Time	32%	26%	18%	6%	18%	0%
Switch Location	3%	15%	32%	21%	12%	18%
Length	3%	9%	29%	32%	18%	9%
Light Type	6%	6%	15%	21%	41%	12%
Battery Type	3%	15%	6%	9%	12%	56%

Slide 25

Prioritization Analysis

Category	Priority	%
Candle Power	1 or 2	82%
Runtime	1 or 2	59%
Switch Location	3 or 4	53%
Length	3 or 4	62%
Light Type	5	41%
Battery	6	56%

Slide 26

Slide 27

Conclusion

- Length Hypothesis correct 44.1% under 12.5" (preferred), 7.5-12.5" was 76.5%
- Battery Type correct, 44% chose lithium-ion. Close finish 35.3% chose nickel cadmium

- 90.9% wanted either model, and if companies produced LED/Halogen combo=bigger market

ACADEMIC REVIEW SAMPLE #1

Journal of Marketing Research, August 2005
"Distinguishing Between the Meanings of Music:
When Background Music Affects Product Perceptions"
Rui (Juliet) Zhu and Joan Meyers-Levy
Page 333-345
(For simplicity, only Experiment 1, pages 333-339, is the subject of this review.)

Overview

"Does background music affect consumers' perceptions of a product, and if so, how?" are two questions addressed in dual studies performed by a team of two marketing professors. Music confers meaning in two ways. The researchers define "embodied meaning" as the pleasurable emotions music produces in the listener by virtue of the tone, tempo, and rhythm qualities of the music. No other intrinsic meaning is imputed to the music. Stimulation is increased by quicker tempos or a familiar piece of music performed in an unfamiliar way, such as a standard hymn set to a contemporary melody or tempo. There is less resource demand to process embodied meaning.

The second type of meaning music conveys is "referential." In this instance music stimulates associations and references in the listener that become its meaning. For example, high-energy, high-volume music is associated with a fun, party atmosphere. Zhu and Meyers-Levy refer to such music as "energetic." Quiet, slower tempo music is associated with situations of dignity, serenity and calm. The researchers refer to this music as "sedate." There is greater resource demand to process referential meaning.

The concept of "need for cognition," (NFC), must be understood to interpret the findings of the researchers. NFC is a measurement of the degree to which one enjoys and participates in the activity of thinking. Individuals identified as high-NFC are more thoughtful and respond more freely when queried. Individuals with low NFC don't like to put out intellectual effort, so would be less thoughtful or responsive.

Research Problem

In general, the study seeks to demonstrate that for high-NFC people, when the verbal information requires a lot of processing, as when it is delivered through a dramatization, rely on music's embodied meaning to form opinions, as this type of meaning requires less mental effort to process. When the information requires little processing effort, as when it is delivered through an announcer simply reading a script, they rely on the referential meaning of music, as this type of meaning requires more mental effort. Low-NFC people, who don't invest much effort in processing information, aren't affected one way or another by the introduction of either type of music to the test.

Imagine a pie that represents the total amount of mental effort available to process both the verbal content of the ad and the musical component of the ad. For a high-NFC person, if a large

piece of that pie is necessary to process the verbal content, there is only a little left to process the musical content. Conversely, if only a small piece of the pie is necessary to process the verbal information, there is a lot left to process the musical information. Low-NFC people would prefer a cobbler so they didn't have to decide how to cut the pie.

Employing a radio ad highlighting a travel agency's dependability and ease of use:

H1a: If the ad script is read by an announcer, high-NFC people will credit the agency with the attributes of dependability and ease of use and good service when the accompanying music is sedate. When the ad is presented in a dramatic format, acted out by actors, high-NFC people will credit the agency with dependability, ease of use and good service when the accompanying music is energetic.

H1b: Low-NFC people are not affected by the manner in which the message is delivered, as they have an aversion to thinking and responding. They will comment on tangential or non-significant issues.

H2: When the ad is read by an announcer and includes sedate music, high-NFCs will remember sedate, thoughtful features of the ad. When it is accompanied by energetic music, they will recall the activity involved in the ad. Neither high-NFC nor low-NFC individuals will be affected when the ad is dramatized.

H3: High-NFC people will react more positively when energetic background music accompanies a dramatic presentation of the ad because the energetic music carries more embodied meaning. Neither high-NFC nor low-NFC people are affected when the ad is read by an announcer.

Research Design and Procedures

Three radio ads were developed, two non-testing ads and an ad for a travel agency extolling its dependability and ease of use. Further, the travel agency ad was recorded in two ways, one with just an announcer and one dramatized by actors. The wording was as close to identical as possible. The ads were engineered so that the amount of effort needed to process the information was the only critical difference. Cited research indicates that it takes more effort to process information taken in through a dramatic presentation than the announcer-read presentation. The two methods of presenting the ads were pretested on 21 people with no accompanying music, and the results supported the findings of that research.

Two versions of an obscure song were recorded for use in the experiment. One was energetic, and one was sedate. The two versions were pretested on 48 people, and the results supported previous findings regarding embodied meaning and referential meaning.
Forty-seven people pretested the appropriateness of the two versions of the song to the ad content, using an itemized rating scale, and found them both to be appropriate.

Seventy-seven students participated in the actual testing in return for extra credit in the course. The test was conducted in three parts: Exposure to the three ads, a perception measure and

thought-listing measure. Half of the group took the perception measure first and then the thought-listing measure. The other half took the thought-listing measure first and then the perception measure, lessening the effect order bias might have on the experiment. Another itemized rating scale was used to discover the perception versus the provision of "hassle-free" service, and then related that number to the sedate music's "referential meaning." Recall of the target ad was re-assessed, and an NFC scale test was administered to the participants in the study to determine their NFC level.

Flaws in Procedural Design

The possibility that 77 students represent a random sample of the general population doesn't seem likely. The offer of extra credit in return for participation in the study could bias the outcome if the students inferred that there was a "correct" way to answer the questions. No control group was utilized to determine whether the results could have been duplicated without the addition of either type of music to the ad.

Findings/Analysis of Data

An NFC scale was used to divide the respondents into high-NFCs and low-NFCs. Their responses were consistent with what was anticipated. H1a: Validated; H1b: Validated; H2: Validated; H3: Validated. The anticipated demonstration of an overall positive reaction to the background music was not shown. The researchers attributed this to the selection of an obscure song and the fact that it was played at a very low level. Changes were made in future tests to remedy this.

The data collected is consistent throughout the models and supports the hypotheses proposed at the outset of the study. The great amount of experience of Zhu and Meyers-Levy in this area of research contributed to the consistency between the hypotheses and the data collected. When a weakness was recognized, they identified it and sought a remedy to avoid the same problem and employed it in future testing.

Research Conclusions and Recommendations

The findings in this study are valuable to those who design and those who use radio advertising for their products or services. The relationship between verbal and musical components of an ad can focus the message to precisely convey the message. When the mental investment required to process verbal information and musical cues is balanced properly, the music subliminally reinforces the intended message, thus strengthening the advertising effort, "getting the most bang for your buck," if you will. When it is imbalanced, the resultant confusion of the message or compounding of the mental effort required to tease out the intended message confounds the goal of the ad, thereby wasting the ad client's money and the ad designer's efforts.

Researchers' Reputations

Both Zhu and Meyers-Levy are widely published, prolific authors, researchers and professors in marketing. Zhu is an assistant professor of marketing at the Sauder School of Business, University of British Columbia. She has published extensively in the "Journal of Consumer Research" and "Journal of Marketing Research," and been a conference presenter for the Society for Consumer Psychology. Meyers-Levy is professor of marketing at the Carlson School of management, University of Minnesota. She serves on the editorial board of the "Journal of Marketing Research," is a reviewer for the "Journal of Consumer Research," and speaks at conferences. Zhu and Meyers-Levy collaborate often on studies for publication and presentation. They have both won multiple awards for their work. These two researchers are well-qualified to perform and analyze the type of research conducted in these experiments.

ACADEMIC REVIEW SAMPLE #2

Pediatrics: *Official Journal of the American Academy of Pediatrics*, June 2005
"The Impact of School Daily Schedule on Adolescent Sleep"
Martha Hansen, MS; Phyllis C. Zee, MD; Margarita L. Dubocovich, PhD; Imke Janssen, PhD; Adam Schiff, BS, pg.1555(7)

Overview

The study on adolescent sleep patterns was a collaborative project between Evanston Township High School, Evanston, IL, and the Feinberg School of Medicine and Center for Sleep and Circadian Biology at Northwestern University. The study, conducted in 1997/1998, gathered data on adolescent sleep patterns during the summer months and during the school year. This data was used to compare bedtimes, awake times, minutes of sleep per night, cognitive abilities, and feelings.

Data analysis verified a significant difference in academic performance between early morning and afternoon testing. The conclusion drawn from this research is that all students perform better academically in the late morning or afternoon than they do in the early morning.

As an experiment, a subset of subjects received light treatments during their early morning class. The treatment group and non-treatment group took quantitative and qualitative tests to measure the affect of the light treatments. The results of this testing showed no significant difference between the two groups.

Research Problem

The research conducted by Evanston Township High School and Northwestern University had four stated objectives related to adolescent sleep patterns. The first objective was to evaluate how sleep patterns change between school days and non-school days (including summers, holidays and weekends). The second goal was to determine if light therapy treatments would positively affect subjects sleep cycle, mood, or academic performance. The third focus of the study was to quantify changes in performance, mood, and vigor due to loss of sleep because of early class start times. The final goal of the study was to educate adolescents of the affects sleep deprivation has on academic performance and health.

Research Design and Procedures

The study utilized multiple tools to reach its stated objectives. The first phase of the study asked for voluntary compliance and was observational in nature. In this phase, sixty AP Biology students kept sleep diaries for extended periods. The second phase involved a treatment group receiving light treatment therapy (1800 lux at ~ 66cm from source for 93 minutes) and a non-treatment group receiving a placebo light treatment. The final phase incorporated cognitive and emotional testing. The subject's pre- and post-treatment tests included portions of the Harvard

Cognitive Performance Battery test. The subjects also completed self-evaluations covering themes related to feelings, mood, and vigor.

The sample selection was limited to the sixty students in AP Biology at Evanston Township High School, Evanston, IL. All subjects were juniors or seniors; the report did not provide additional demographic information on the students. ETHS (Evanston Township High School) has approximately 3,000 students; of the 3,000 students, 541 took an AP exam in 2007 (not the year of the study). The sample group for the study does not qualify as a simple random sample (SRS).

Each subject began the study by tracking his or her sleep pattern in a daily diary. The sleep diaries required that the subjects track the date, his or her bedtime, wake time, how many times he or she woke during the night, and naps. The subject kept sleep diaries for the following periods: the month of August, the first two weeks of September (after the start of school), the last week of October through the third week of November, and the month of February. Three and a half months of sleep diary data was collected and compiled by the AP Biology students. Analysis of the data, conducted by the faculty of Northwestern University, highlighted the issue of sleep cycles of adolescents.

The treatment phase of the study broke the subjects into three non-random groups, with group "A" receiving light therapy treatment, and group "B" and "C" receiving placebo light treatment. The groups were determined by class times:

- A = 8:10 – 9:43am
- B = 9:48 – 1:25am
- C = 1:08 – 2:41pm

Group "A" received two cycles of light treatment for nine non-consecutive days. The light treatments were non-consecutive due to school holidays and weekends. The first cycle was from November 10, 1997 to November 21, 1997. The second cycle was from February 17, 1998 to February 27, 1998. Groups "B & C" received placebo light treatments during the same times. The team's goal was to determine if light treatment therapy would affect the circadian rhythm, or the academic performance of the subjects.

The final component of the study involved quantitative and qualitative testing. The quantitative test measured reaction time to visual stimuli. The qualitative test utilized self-evaluation of the subject's feelings measured on an analog scale. The testing coincided with the light therapy treatments and took place on two consecutive days at the beginning and end of November and the beginning and end of February. On test days, the subjects repeated the same battery of exams three times: before school (6:30 – 8:00am), during midday break (11:30am – 1:00pm), and after school (3:00 – 4:30pm). The test results were the final piece of data required to draw conclusions about the affect of adolescent sleep patterns on academic performance and mood.

Findings/Analysis of Data

The results of the sleep diary portion of the study show that the "loss of sleep between non-school days and schools is significant ($P<.0001$)," (Hansen, 1558). On average, subjects lost two hours of sleep per night between non-school days and school days. It also showed significant

differences between weekend sleep in August and in September (P<.0001), with the average minutes of sleep on a September weekends increasing ~ 30 minutes. The authors suspect that the extended sleep time on the weekends in an attempt to balance sleep debt accumulated during the week.

The light treatment group "showed no significant differences in sleep patterns from the placebo group and were not significant (P<.90)….The light treatment group reported feeling less vigorous throughout the study (P<.0003), and all students felt less vigorous in the morning than in the afternoon (P<.0001)," (Hansen 1558). Furthermore, "all students performed better in the afternoon than they did in the morning (P<.001)," (Hansen 1558).

Overall, I found this study lacking in the scientific process that would have substantiated the results. Aside from the statistical analysis, the study read like an AP Biology science project. In my opinion, the results of the analysis are not valid because of the numerous confounding variables. The experiment's loose design, the lack of a control group and baseline testing, prevents me from accepting the conclusion that light therapy has no affect on the academic performance or the disposition of the subjects. Due to the 38% studies mortality rate and homogeneous sample population, the sleep diaries are bias and not valid for the general population. Although the study was undoubtedly a great learning tool for the AP Biology class at ETHS, it lacked the basic qualifications that would have elevated it to a higher level of research.

Flaws in Procedural Design

The study and experiment had fundamental flaws in its set-up and implementation. First among said flaws is the lack of pre-experiment testing. Second was the homogenous nature of the sample group. Third is the lack of a control group in the light therapy treatment experiment. Fourth was the limited educational impact of the study, and fifth are the many confounding factors.

Skipping the pre-experiment process impaired the study tremendously. An example of this is the exclusion of a base-line test prior to the start of the study. Because there was no baseline cognitive test, the assumptions about academic performance are questionable. Additionally, the authors would have chosen cognitive tests that provided detailed data. Unfortunately, the results from two of the three cognitive tests used in the study had to be thrown out because the students all got 100% every time. A simple pre-experiment would have exposed these problems, so the group could address the issues prior to the start of the large study.

The homogenous nature of the subjects limits the application of the resulting data. The population of interest was all adolescents, but the sampling was not representative of said population; therefore, it was not a SRS. The subjects came from a college level biology class, where typically the students are hard working, focused on math and sciences, and ambitious. The data collected still has value when added to other studies on adolescent sleep patterns.

The lack of a control group in each group (class period) limits the comparisons made with the data. I believe the study should have been set-up with a control group in each class period. The

design of the study, with only the subjects in the earliest class receiving the light therapy, makes it difficult to compare the post-treatment test results with the other groups. The pre-treatment qualitative and quantitative test results are valid, but the addition of control groups would have greatly enhanced the data collected.

The report makes no mention of how or if the information gathered was disseminated to the total student population of ETHS. The report highlights education as one of its objectives, but it does not document the education process or submit data on what the students learned from taking part in the study. In my opinion, the subjects could have been more involved in the dissemination of the studies finding, if not to the community as a whole, then to the high school student body.

Finally, there is a substantial list of confounding variables attacking the underpinning of the study. Interruption of the light therapy during the weekends and school holidays might have negatively affected the results. It is also quite possible that because no schedule changes (reduction of extracurricular activity, homework, chores, etc.) were implemented during this period, the students were not able to respond to circadian changes. Also likely is that the placebo group and the treatment group spoke with each other about the experiment; these conversations could have revealed information affecting test results.

Compliance most certainly was a major confounding factor in the study. The subjects were required to keep sleep diaries on a daily basis for three and a half months. The information in the diaries is not verifiable; therefore, accepting the data requires a degree of skepticism. Finally, the mortality rate on the study was quite high. The study lost 38% of its subject between August and September. The sleep pattern analysis was based on data collected during August and September, so such a high mortality rate severely undermined the results of the study.

Research Conclusions and Recommendations

The authors state that the study supports the idea that adolescents have developmental needs that schools are interrupting by having early start times. Additionally, it states "school schedules are forcing them [students] to loose sleep and to perform academically when they are at their worst." I do not believe that the study gave concrete evidence to support their conclusion. The study evaluated adolescent preferred sleep patterns, rather than their physical sleep requirements. According to National Institute of Health, adolescents require approximately nine hours of sleep a night to support the physical changes their bodies and minds are undergoing. In order to prove that school schedules are undermining student's academic performance, it would have needed to address the issue of how much sleep each of the subjects was getting. Instead, the study focused on bedtimes and wake times.

The authors put forth four recommendations to their intended audience of physicians, educators, parents, and adolescents. Their first recommendation was to continue research on the subject of adolescent developmental needs. This is a reasonable recommendation, however the suggestions made in the paper to sign-up students to a four-year study in not practical. Furthermore, there is already strong scientific evidence that adolescents circadian rhythms shift later in the day.

The author's second recommendation was to change school start times throughout the state of Illinois. Again, this is neither practical, nor realistic. Within the constructs of state requirements, school districts have flexibility over their calendars and class schedules', asking an entire state to conform to one schedule is not reasonable.

The team's third recommendation was to change the time standardized tests are given from 8:00 to 10:00am. High schools have control over when they administer standardized tests, so this is a relatively easy change to implement. In my research, I found a few states that have changed the recommended start time for standardized tests from 8:00 to 10:00am.

The group's final suggestion was to increase education for the benefit of all stakeholders: physicians, educators, parents, and adolescents. The paper did not list specific methods of disseminating information, perhaps because the NIH has an active campaign targeting adolescent sleep requirements. The NIH program offers practical suggestions for physicians, educators, coaches, parents, and students to work together to make time for the proper amount of sleep.

Researcher's Reputation

- Martha Hansen, MS - high school AP Biology teacher. No other publications.
  She was very biased throughout the report. My opinion is supported by the comment, "Posner data were not used because these *bright students* quickly learned the test and were able to score 100% after the first trial." Further it is written,"…all of the students in AP biology classes (are) *motivated and engaged.* This assisted us in obtaining *high-quality* sleep journal records." The accuracy of the sleep journals was not verified. The author shows prejudice toward the subjects, which clouds her scientific reasoning.

- Phyllis C. Zee, MD - Director of Sleep Disorders program and Professor at the Northwestern University School of Medicine.
  Her research and writing focuses on sleep disorders and non-pharmacological remedies to sleep disorders.

- Margarita L. Dubocovich, PhD - Professor of Molecular Pharmacology and Biological Chemistry at Northwestern University School of Medicine.
  Her research and writing focuses on the molecular affects of melatonin on dopamine receptors working toward therapeutic treatments of circadian sleep disorders, depression, insomnia, and cancer.

- Imke Janssen, PhD - Statistician and Evanston Township High School parent.

- Adam Schiff, BS - Former Evanston Township High School student.
  He is currently a medical school student (as of publication June 2005).

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