MASTER'S DEGREE HIGHLY DESIRED:

MEASURING THE INCREASE IN PRODUCTIVITY DUE TO MASTER'S EDUCATION IN THE UNITED STATES NAVY

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ABSTRACT

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Can the value of a Master's degree be measured? The value of education is generally thought of in terms of returns to an individual, namely a higher salary, greater promotion opportunity, or a better. Yet, for an organization to be willing to pay higher salaries for people with more education, there must some increase in productivity associated with Master's level education. This dissertation develops a way to measure that productivity using the United States Navy as a model. A survey that asks people who have observed and supervised people with and without Master's degrees to distinguish differences in productivity between these two groups is designed. Productivity is defined in terms of the outcomes expected of education. The survey consists of ten scenarios that demonstrate mastery of these expected outcomes and asking supervisors how capable officers are of making the decision or performing the tasks in each scenario. Pairs of officers are then asked to answer the survey about officers in their organization. This provides a measure of the reliability of the survey. This research is largely exploratory in nature. It seeks to provide a better understanding of productivity

gains associated with Master's level education and test the feasibility of undertaking a more extensive study.

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I. INTRODUCTION

Master's degree in related field highly desired.

These words are seen more and more frequently on job announcements. And, the number of people who are responding by pursuing Master's level education has matched the trend, most notably in the fields of business and education, but also in engineering, communications, information science and other areas. (U.S. Department of Education, 2001). The number of institutions classified as Master's institutions according to the Carnegie classification has also grown by 34 percent (Carnegie Report, 2000) and the number of Master degree programs, both those for part-time working adults, as well as for full-time students has also grown considerably (Kumagai, 1999). These trends stimulate interest about what is behind this emphasis on education at the Master's level. Why are companies demanding more people with Master's degrees? What skills, knowledge and abilities do people with Master's degrees bring to an organization that enhances its productivity? Or, what is the value of Master's level education?

The concept of value in education most often comes up in a discussion of the cost of education. It is no secret that rising costs have been at the top of the list of issues facing the higher education industry since the 1980's. In order to better understand the costs, state legislatures, accrediting bodies, governing boards, and students and their parents are demanding that universities provide evidence of the value of education to their students and graduates. Universities, and the organizations that support and study higher education, have responded with an emphasis on outcomes assessment, and, in

particular assessments of what and how much a student has learned through the course of study at a university. (Gaither, 1995; Halpern, 1987; Haworth, 1996).

Universities are at various stages in the development of comprehensive assessment programs that represent campus-wide evaluation. Assessments take many shapes and sizes and include everything from comprehensive exams and final projects to surveys of both alumni and their employers. However, many assessments, like most education quality rankings, continue to focus more on university prestige, reputation, and inputs into the program. Outcome measures that are used are generally related to the starting salary and placement rates of the graduates of the program.

Despite the emphasis on education outcomes that is sweeping through the academic community, Haworth (1996) notes that little has been done to assess the effectiveness of the graduate degree, either at the Master's or Doctoral level. There are many reasons for this. First and foremost may be that those associated with education at the doctoral level resist the idea of a formal assessment program. The processes leading to the award of a doctoral degree tend to be very individual-oriented and closely monitored by senior faculty. However, this is not true at the Master's level.

Typically, there are three categories of education beyond the baccalaureate level, doctoral, professional and master's. The professional education category generally includes those with specialized degrees such as doctors, lawyers, dentists, and veterinarians. In many instances, the other two categories, master's and doctorate, are often lumped into a single one called "graduate" education. When this happens, doctoral education is the one that tends to get the most focus or attention. As Conrad, Haworth and Miller (1993) note, many still view a Master's degree as something between a

baccalaureate and doctoral degree, but not as its own defined entity. Consequently, it is difficult to find many stakeholders for Master's education.

However, this may be changing. As our world becomes more complex, many more fields are requiring a "professional" workforce, and the Master's degree may be one of the key elements of this new workforce (Mingle, 1987). This has long been true in the field of education. The growth of the Master's of Business Administration (MBA) degree has moved the business community in this direction, and other fields, particularly computing and information technology are following suit. Other areas such as Operations Research and Management Science have recognized that there is such a demand for people with a certain level of skills in an area that it is time to consider setting guidelines for standard curricula (ORSA/TIMS 1993). And, since 1997, in an effort to equip graduates of science and mathematics programs for work outside academia, the Alfred P. Sloan Foundation has sponsored a group of programs that they call "Professional Science Master's Degrees" (Tobias, 2002). This type of Master's degrees, one that is not viewed as either a step on the path to a Ph.D. or as consolation prize for not completing a doctoral program, is the focus of this dissertation.

Considering the nature of this type of Master's degree, it is particularly surprising that little work has been done assessing the effectiveness of this education (Haworth 1996). It would seem that the expected and actual outcomes related to the teaching and learning that occurs in these programs could be more readily identified and measured than those for an undergraduate degree program or for the more individually-oriented Ph.D. There are several possible reasons why this is not the case. First, since these Master's degrees are associated with professional organizations, such as the various

professional engineering or accounting societies, they tend to have specific goals that are related to the different professions and less with the more general outcomes or benefits that would result from a higher level of education. In many cases, Master's degrees are considered to provide an acceleration of skills obtained in an undergraduate program or in the work environment. Additionally, there are challenges in deciding the purpose of outcomes assessment, who should be responsible for designing and executing the outcomes assessments, and what constitutes an outcome for this type of education (Conrad and Bilder, 1996).

There is, however, some evidence about the effectiveness of Master's programs. As is the case with education in general, most of it is related to salaries. The Current Population Survey (U.S. Department of Commerce, 1999) reinforces the relationship between education and higher salaries. It shows that master's-degree holders earned $52,317, 23 percent more than bachelor degree recipients. Additionally, a recent report on the economic impact of the University of Hawaii reported that a typical resident that obtains a Bachelors degree will earn over $1 million more over their lifetime than a high school graduate. If that person goes on to earn a graduate degree they can expect to earn over $2 million more (Mak et. al., 2000).

So, what accounts for this salary differential? Human capital theory suggests that a profit-maximizing firm will only pay higher salaries if they realize a gain in productivity (Becker, 1964). This dissertation will explore whether there is a way to qualify and measure this increase in productivity.

The United States Navy provides an excellent case study for considering the increase in productivity due to professional Master's education programs. In the private

sector, an employee may choose to leave the work environment for a period of time in order to pursue a graduate degree, and thus change his or her employability status, most often with another firm. Alternately, a person a may choose to attend an education program in order to prepare for another career. There is little, if any, opportunity for a Naval officer to do this same thing as the military is a closed personnel system. Officers join at the entry level, generally with an undergraduate degree and move through the ranks according to an established sequence. Any subsequent education of an officer must be either provided by the service as part of that officer's career path, or obtained by the officer in their off-duty time. The Navy sends about 700 officers to full-time Master's degree programs each year. About 350 of these officers attend the Naval Postgraduate School for education in a variety of disciplines including several types of engineering, computer science, information technology, applied physics and management and business. These programs are designed to meet the specific needs of the Department of the Navy. In many cases, the graduate degree program does not match the undergraduate degree of the officers. Thus, there is an opportunity to evaluate the knowledge and abilities actually obtained in the Master's program. For each program, the Navy has specified a set of knowledge, skills and abilities that are required of graduates of the program. Upon completion of their degree program, officers are expected to work in jobs requiring the education they have obtained. Often this occurs immediately after school, but many times it is several years later before the officer is assigned to such a position.

This dissertation provides a way to measure the increase in productivity obtained from Master's level education. I have designed and tested a survey that can be used to

distinguish differences in productivity between these officers with and without Master's level education.

For the Navy, this should answer questions about the value of providing education to the officer corps, even if the officer does not use the education for many years after they obtain it. It is costly to send officers to full-time education programs, and even more so to own and operate a graduate school like the Naval Postgraduate School. Some way to measure the increase in productivity gained through education would be useful in justifying the continued need for spending resources on education for the officer corps. Alternately, the Navy may decide that the increase in productivity currently achieved is not sufficient. It could then take appropriate measures that might include changes in education policy or funding levels.

The results of this study are valuable to higher education as an industry because it adds to the discussion on program outcomes, assessment and effectiveness. The accrediting bodies, state legislators, parents, and students are asking for more data and information about what their tuition dollars buy for them. This dissertation provides a model for answering questions about increase in productivity due to education. This instrument could be adapted or modified for a variety of purposes.

For the Naval Postgraduate School, this study provides information on the effectiveness of our programs in terms of providing skills, knowledge and abilities that have an impact on productivity. It is hoped that the Naval Postgraduate School will also be able to use the results of this survey for program improvement as part of a comprehensive outcomes assessment program as suggested by Ewell (1987).

II. LITERATURE REVIEW

A. EDUCATION AND HUMAN CAPITAL THEORY

The most obvious and most often quoted way to answer a question on the value of a Master's degree is to point to the salary differential between those with bachelor's degrees and those with master's level education (Ehrenberg and Smith 2000), especially when taken over the course of career. There is also general agreement and significant research to provide evidence that education benefits the individual and the public in both social and economic terms (Institute for Higher Education Policy, 1998). Yet, there continues to be a great deal of research to further define the economic returns to education (See for example, Arias and McMahon, 2001, Blundell et al., 1999, and Wagner, Smith and Healy, 2000). Much of this work is still largely based on Gary Becker's *Human Capital* (1964) which first presented the idea that investment in human capital can be viewed and measured in much the same way as physical capital. Becker went on to develop an analytical model that provided evidence of the individual and social returns to education.

In general, the return on investment for education is discussed in three ways, for the individual, the organization and the nation. At the individual level, people with more education earn higher salaries. This motivates people to make investments in their own education. Some people will take themselves out of the workforce to go back to school for extended periods of time because they believe that they will recoup the lost wages for the time they spent in school through higher salaries over the course of their career. More and more, people are also going back to school on a part-time basis, taking time

away from family and social lives in hopes of obtaining a better job or to somehow improve their employability.

Organizations invest in fully and partially funded education and training for their employees because they are looking for gains in productivity, that is, they want their firm to be more competitive and thus more profitable. They understand that the way to achieve this is through people. Economic theory suggests that a firm invests in training and education only if there is an expected pay-off; consequently, firms are more likely to invest in firm-specific, rather than general, education.

Finally, states and countries invest in education at all levels because of the evidence that shows that a better-educated workforce is a more innovative and productive workforce. Economists point to the many positive externalities or spill-over effects of a better-educated workforce that may not be captured by an individual, but nevertheless benefit society as a whole. These effects include the health, citizenship, intellectual tolerance, life-long learning, and the propensity of children of educated people to seek at least that level of education. (Becker, 1964; Ehrenberg and Smith, 2000; Breneman, 2001).

B. HUMAN CAPITAL THEORY AND ORGANIZATIONS TODAY

There are several current trends that require organizations revisit the traditional human capital model described above. In particular, organizations may need to re-consider the type of education and training they will provide to their employees, and who should pay for that training or education. Additionally, they may need to consider the return they get for such training, that is what productivity gains do they expect to get, and how they will measure them.

Companies in today's knowledge-based society are placing an even higher emphasis on human capital than ever before. Recent popular business books including *The War for Talent* (Michaels, Handfield-Jones and Axelrod, 2001), *Intellectual Capital* (Stewart 1997, 1999) and the *ROI of Human Capital* (Fitz-Enz, 2000) all point to the need for organizations to think more strategically about the investment in the development of the intellectual capital of an organization. Stewart calls intellectual capital the "collective brainpower" of an organization, "everything that can be used by an organization to create wealth." He discusses the rise of "knowledge workers" and indicates that information and knowledge are both the raw material of their labor and its product.

Closely related to the realization by organizations that the intellectual capital is one of their most strategic assets, is the realization by individuals that they are a valuable resource for the company. They expect and deserve to be treated as such. Cascio (2003) describes this as a change in the psychological contract between organizations and their employees. He describes one part of this as the shift from "job security" or knowing one has a job, to "employment security" which implies that one has skills that some employer in the labor market is willing to buy. He contends that "organizations will need to create the kinds of cultures and reward systems that keep the best minds engaged." In a telling example of this, the reason that Microsoft incorporated was not to raise capital, but to give employees a share in the company and thus, preserve the human capital of the organization (Stewart 1999). The strong economy of the 1990's, spurred on by the tremendous growth of electronic commerce and internet-based businesses, allowed employees to shop around for the best place to work. Additionally, Judge et al. (1995) in

a study of executive career success, find that career success is linked to motivational and organizational factors as well as to more objective measures such as number of promotions and compensation.

A third trend that impacts companies and their investment in education and training, is the "professionalization" of many occupations. As employers are demanding a more professional workforce and rapid changes in technology and knowledge require that people continue to develop their own skills and abilities to keep abreast of these changes, many professions that typically require a minimum of a baccalaureate degree for entry now require a Master's degree in order to move beyond the practitioner level (Syverson, 1996). This idea was introduced and discussed in the 1987 publication, "The Master's Degree: Jack of All Trades" (Green, 1987).

There is also growth in the definition of a "professional." The term used to be reserved for those who had either graduated from a "professional" school such as law or medicine, or that had mastered a specific body of knowledge, such as that which could be learned in schools. But, today that description might be expanded to include people in occupations that presume mastery of the field. Specific practices, heuristics, information and tacit knowledge are required in addition to a significant amount of preparation, practice and on-the-job knowledge. These people generally have a Master's degree in an area related to, or complementary to, their occupation (Oblinger and Verville, 1998).

Thus, as companies and organizations realize the impact of these trends, they may need to rethink policies for paying for both general and specific education and training. Companies also need to think about new ways to measure productivity, particularly as

defined in terms of intellectual capital for they will need to know and better understand their investment and the expected return on that investment.

C. PRODUCTIVITY AND EDUCATION

1. The Measurement of Productivity: Value Added

Alexander Kern (1993) concludes that although the investment in education is fully justified by economic analysis, it is still important to attempt to quantify the full value of having an educated population. He lists some of the benefits of education that are not generally recognizable, nor easily measured. They include the benefits that accrue to family and social life, in the workplace, to neighbors and society, and to wealth in general. If these benefits were able to be quantified, then the value of an educated society would be even more profound. More recently, Psacharopoulos (1996) presents a research agenda for the economics of education that still calls for more research into the benefits or returns to education.

In a discussion of the intrinsic value of education, Doost (1997) describes the difficulty in measuring the value of education. He says,

> Putting a value on higher education (as opposed to cost) is possibly an impossible task. On my way to work this morning, I was thinking about this question in several ways. What is the value of knowing mathematics: What is the value of being able to read and write. Would you rather live in a mansion with servants and all other amenities or live in a shack but be literate? By the same token, I do not think the privilege of being introduced to the works of Socrates, Plato, Aristotle, Shakespeare, plus all the poets, philosophers, and scientists that you have visited during your academic career, is comparable to the cost of any car, any mansion, or any amount of money in the bank. How can you measure the value of love and life? For many of us who have savoured the taste of knowledge and understanding, nothing, absolutely nothing, compares to this joy of learning.

Despite this difficulty in measuring the value of education, there is still a demand for better understanding of the value of education. In a discussion on assessing the quality of education Bennett (2001) indicates that the "value-added" approach is the only value approach to assessment. He indicates that assessments must seek to identify the improvement in students' capabilities and knowledge as a product of their attendance at a university or college.

Several studies in recent years have attempted to look at measuring the value added of education in different ways. Tracy and Waldfogel (1997) consider the rankings of business schools from a market-based approach. They attempt to isolate the value added by particular MBA programs. They use the typical measure of the starting salary of their graduates, but they control for the quality of the students that start the program and for certain job attributes, such as whether the job is in the private or public sector. They find that many of the same business schools that are typically rated high in other quality rankings, namely Business Week, also rated well in accordance with their model. They did find, however, several other schools that scored high in terms of value-added that do not normally make the other rankings.

In a series of studies on academic productivity at the elementary level, Thum and others (Bryk et al., 1998) develop a way to look at the value added by the education from year to year. Their research started out to assess the effectiveness of the Chicago public school system. Dissatisfied with typical measures of effectiveness, they developed a productivity model that considers three elements: the input status, the learning gain, and the output status. They test students at the start and end of each year of education under consideration, careful to omit students who were not there at either the start or the end of

the school year. By comparing the test scores at the end of the one year to the test scores at the end of the following year, and then considering the learning gain as the slope of the trend line between inputs and outcomes, they are able to gain insight into the value added of that year of education.

In another study of the relationship between human capital and productivity, Horowitz and Sherman (1980) used the United States Navy as an example to show that differences in pay do not necessarily equate to differences in productivity. Their work suggests that it is important to have other measures of productivity, besides earnings, in human capital studies. Using the ability of a ship's crew to maintain complex equipment as a way to measure productivity, they found that productivity is a function of characteristics, including both educational level and training. Additionally, they found that the complexity of the equipment was a factor. Specifically, men with higher skill levels made a big difference in the availability of more complex equipment.

Finally, in a study that looked at business productivity as defined as the dollar value of sales, receipt or shipments in a year, Black and Lynch (1996) find that human capital does have an impact on the productivity of a firm. Using data from the EQW National Employers Survey, Black and Lynch construct a Cobb-Douglas production function for business productivity. They find that the average educational level of an organization has a positive and significant effect in both the manufacturing and non-manufacturing sectors. They estimate that a one year increase in the average number of years of schooling may equate to an 8.5 percent increase in business productivity for manufacturing firms, and an even higher (12.7) percent increase for non-manufacturing firms.

2. Measuring the Value of Firm-Specific Training and Education

In the same study of business productivity discussed above, Black and Lynch (1996) found that the content of training is important. Particularly for non-manufacturing firms, it is the type of training provided that impacts productivity, not just whether a firm provides some training. This supports the theory that firm-specific training provides the greatest pay-off for an organization as training related to the industry provided a greater impact on productivity. It is interesting to note, however, that some training, such as computer skills development, increased productivity across industries. This may have implications for the future as more and more firms turn to the knowledge-based workers.

Feuer, Glick, and Desai (1987) contest the theory that companies will not reap the benefits of general training, and therefore should not invest in it. For the study, they use a longitudinal survey of natural and social engineers and scientists. They build upon their earlier work in which they reported that if general and specific training are provided together, which often happens, then a worker is not more likely to leave the firm for another as long as the worker feels that the total return from both the specific and the general training exceeds the market value of the general training. In other words, an employee invests in specific training, which has little market value for the employee. However, the employee "pays" for that education in foregone earnings during the time of the training. The general training has a much greater potential return on the market for the employee so they are more willing to "pay" for that training. The firm, on the other hand, gets a better return on specific training. However, again, if the employee feels that the total return from the training exceeds the market value of the general training. In this study, they develop a model which suggests that a firm may have more to gain than to

lose by investing in both general and specific training. They find that there is not a significant risk of greater employee turnover associated with general training of employees.

Feuer, Glick and Desai suggest that this work is especially important as the nation and organizations think about preparing workers for the future. They believe there are significant incentives for firms to invest in both general and specific training.

The value of firm-specific education for the United States Navy has been studied in previous work. Bowman and Mehay (2000) looked at the possibility of monetizing the return on investment for educational opportunities, particularly for the graduate education provided by the Navy for its officers corps.

In their cost-benefit analysis of graduate education programs, Bowman and Mehay find that there is a benefit to the Navy in providing graduate education to the officer corps and that the return to full-time funded graduate education programs is greater than the benefit from part-time or off-duty education programs. In the study, Bowman and Mehay are able to consider all the costs, but only some of the benefits of graduate education for the Navy. They consider the costs of providing education, including the opportunity costs, or loss of productivity for the officer while he or she attends a graduate education program. They evaluate these costs against the benefits of greater retention and labor productivity for those with Master's level education compared to those without it.

Bowman and Mehay consider the Surface Warfare community in their analysis. Analyzing the effect of different types of graduate education on the retention and promotion of Surface Warfare officers who appeared before a promotion board at any

time between 1981 and 2000, they find that the Navy would have to bring in significantly fewer officers if they provided those officers with graduate education. There would therefore be reduced accession costs, a significant benefit.

In order to estimate the increase in productivity, Bowman and Mehay considered the competitive labor market model that aligns earnings differences with productivity differences. In general, people in the civilian sector with graduate degrees tend to make 10-12 percent more than those in the same profession without a graduate degree. The model further indicates that the highest rate of return in earnings is for those with technical degrees, such as engineering, computer science, and operations research. In the civilian sector, people with graduate degrees in technical areas tend to make about seven percent more than those with graduate degrees in non-technical areas. Bowman and Mehay apply these differences in earnings as differences in productivity for the Navy.

Since Bowman and Mehay were unable to quantify all the benefits of graduate education, their results under-estimate the actual benefit. Yet, they found that graduate education in general, and funded graduate education in particular, provide significant benefit to the Navy.

Bowman and Mehay suggest that other communities would also need to be studied, in addition to the Surface Warfare community. They also acknowledge that, in order to refine their cost-benefit analysis, both tangible and intangible benefits would need to be considered. These benefits include the use of officers in jobs specifically related to their education, the military-specific applications gained in Navy-sponsored education, and the ability of the Navy to steer officers into fields that are required to enhance the productivity of the Navy.

Melese (2000) contends that the Navy's investment in graduate education for officers' has multiple returns that can be measured in contributions to two key objectives of the Navy, productivity and effectiveness. He examines the processes of the Navy's educational system, namely teaching, research, consultation on fleet projects and operations, and publication. He then provides a framework for considering how these processes contribute to future productivity and effectiveness in terms of people, equipment and organizations.

3. The Master's Degree and Productivity

The Master's degree is one of the fastest growing segments of the higher education system, and has been for the past twenty years. According to the Carnegie classifications (Carnegie Foundation, 2000) from 1973 to 2000, the number of universities classified as Master's institutions grew from 456 to 611, a 34 percent growth. At the same time, the number of doctoral institutions grew by 51 percent to 261 over this same time period. Many of the institutions classified at the Master's level in 1973 moved to the doctoral level in 2000. Of the 533 institutions classified at the Master's level in 1994, 21 moved to the doctoral level while 91 of the 645 Baccalaureate colleges moved to the Master's level over that same time period.

Between 1984 and 1996, the number of master's degrees conferred increased by 30 percent to 387,070 (U.S. Department of Education, 2000) and then to 429,000 in the 1997-1998 academic year (Carnegie Report, 2000). This growth mirrored the growth in overall graduate education enrollment and can be attributed to several things including the downturn in the economy in the early 1980's, the upgrading of job requirements, and the increase in the number of women seeking more education as they entered the professional workforce. (Syverson 1996; Oblinger and Verville 1998).

Syverson contends that the demand for Master's education will continue to grow. He believes that higher education entered a new era in the mid-1990's, that of market segmentation. He argues that more and more people will demand graduate education, at both the Master's and Doctoral level. He also believes that employers will continue to demand a more professional workforce. Rapid changes in technology and knowledge require that people continue to develop their own skills and abilities to keep abreast of these changes. Additionally, many professions that typically required a minimum of a baccalaureate degree now require a Master's degree in order to move beyond the practitioner level.

Along with the growth in enrollment and institutions that award Master's degrees, there has also been considerable growth and change within Master's programs. While Master's degree have long been characterized as different from other degrees in the areas of "specialization" (proliferation of highly specialized programs), "professionalization" (proliferation of programs for practitioners), "application" (integration of practical experience), "decentralization" and "depersonalization" (meaning no universal standards of residency and mentorship) (Spencer, 1986), these differences have become more profound in the past two decades. This is in response to the changing needs of business and occupations as described earlier. Additionally, or perhaps because of the needs of business and business professionals, there has also been change and innovation within Master's programs, particularly in delivery and content. Four innovations: instructional technology, external or off-campus degree programs, experiential learning, and a trend away from a thesis requirement (Conrad and Eagan 1990) have enabled such innovation.

Oblinger and Verville further amplify the definition of a professional as people who produce intangible outputs. Professionals engage in symbolic analysis services which include problem identification, problem solving and problem brokering. They give examples of professionals in the corporate world as research scientists, software engineers, civil engineers, investment bankers, public relations executives, management analysts, systems analysts, and others. Oblinger and Verville also discuss the growth in the number of technicians who they define as people that handle complex software, data, techniques and processes. The job of the technician depends more on technology and techniques than on analysis. While they must master a body of knowledge, but it is generally less complex and more physical than that required of a professional.

D. THE OUTCOMES OF EDUCATION

In order to think about productivity in terms of education, one must consider what the outcomes of education. Much work has been done in the past in this area, although little of it is centered specifically on graduate education, and even less specifically on master's level education. A report done by the Institute for Higher Education Policy (1998) catalogs the outcomes of education nicely into the four categories of economic and social benefits that accrue to both the public and private sector. Table 1 shows the array of these benefits.

Table 1. Economic and Social Benefits of Education for Public and Private Good.

	PUBLIC	PRIVATE
ECONOMIC	Increased Tax Revenue	Higher Salaries and Benefits
	Greater Productivity	Employment
	Increased Consumption	Higher Savings Levels
	Increased Worker Flexibility	Improved Working Conditions
	Decreased Reliance on Gov't Financial Support	Personal/Professional Mobility
SOCIAL	Reduced Crime Rates	Improved Health/Life Expectancy
	Increased Charitable Giving/Community Service	Improved Quality of Life for Offspring
	Increased Quality of Civic Life	Better Consumer Decision Making
	Social Cohesion/Appreciation of Diversity	Increased Personal Status
	Improved Ability to Adapt and Use Technology	More Hobbies/Leisure Activities

Oblinger and Verville (1998) contend that business today, and in the future, needs a different type of graduate. Business needs people who can change. They attest that business needs people who are "successfully intelligent." They draw upon the work of Sternberg (1996) who says that successfully intelligent people think well in three different ways: analytically, creatively, and practically. Sternberg contends that higher education tends to value analytical intelligence over the other two. While it is clearly important, it needs to be balanced with the other types of intelligence. Oblinger and Verville list the following as what business wants from higher education:

- Successful Intelligence
- Personal Qualities and Skills
- Skills for a Flexible Organization

- Knowledge of the World of Work and Corporate Culture
- A Mix of Skills and Broad Education
- Communication
- Teamwork
- Interpersonal Skills
- Solving Problems and Making Decisions
- Creativity
- Leadership
- Project Management
- Continuous Learning
- Practical Experience

1. The Outcomes of Graduate Education

While many of the same benefits that accrue from undergraduate education are also the outcomes of graduate education, there are also other benefits that graduate education provides. Corporations that encourage graduate education among their employees do so because they believe the course work, reading and research involved in graduate studies enhances understanding, skills, and readiness for leadership (Dowdall, 2001). A survey of Chief Executive Officers indicated that they believed that graduate education provided executives who could:

- Better think logically; deal with complexity
- Better solve problems with proven methodology
- Better conceptualize
- Better model situations toward analytical solutions
- Better create new ideas and innovative approaches (Meister, 2000)

Again, it is unclear whether these are new skills obtained from graduate education, or whether they are simply accelerations of the qualities obtained in undergraduate studies. In a study to provide information on the importance of analytical

abilities toward success in graduate work, Powers and Enright (1986) found the following attributes to be important:

- Reasoning Skills
- Problem Definition
- Constructing Hypotheses or Arguments
- Analyzing Arguments
- Drawing Conclusions

While these attributes are expected to predict success in graduate work, presumably, the graduate work would also accelerate these skills in a person who undertakes graduate work.

E. GRADUATE EDUCATION AND THE NAVY

The Navy is part of the Department of Defense which has its own compensation system, rules governing profits and losses, human resource constraints and a clearly-defined and unique mission. Because of the nature of this system, the Navy must consider investment in education not only as an organization or firm, but also as a state or nation might do so. In many ways, the Navy can be likened to a state's economy in terms of the education. It benefits from the public economic and social benefits described earlier in this chapter that include the health, citizenship, intellectual tolerance, and propensity for life-long learning. In addition, the Navy has to consider investment in education as any other organization would do. It must make decisions regarding the level of education required of its workforce, and how much of those costs should be borne by the Navy, for both general and specific education. While not motivated by profits, clearly, the Navy wants to remain competitive, certainly in accomplishing its mission to defend our nation, but also in the ever-increasing competition for resources within the federal government.

It is clear that the Navy recognizes the value of education. The minimum requirement for entry into the officer corps, those expected to lead and manage the Navy, is a baccalaureate degree for the officer corps. Enlisted are expected to have a high school degree or its equivalent. Additionally, the Navy spends over $10 billion dollars on training and education, highly encourages its enlisted members and officers to pursue educational opportunities, and funds graduate education for its officer corps.

Additionally, the Navy provides graduate education on a full-time, fully-funded basis to about 700 officers per year and to an additional 200 officers in programs that are part-time, partially funded, or both. The Navy provides this education to meet some specific goals and objectives.

- To ensure that officers are able to optimally perform in billets requiring specific skills and knowledge required of the positions.
- To enhance the performance of officers in areas such as critical thinking, analysis, resource management and decision-making.
- To ensure the retention of a sufficient number of officers.
- To ensure the professional development of officers in military and navy subjects.
- To meet the personal needs for professional development of individual officers. (Graduate Education Review Board Working Papers, 2002)

From an individual Navy officer's perspective, he or she will be thinking of their education in terms of maximizing both their in-Navy and post-Navy career opportunities. The military compensation system is not designed to pay more for those with more

education (beyond the officer/enlisted separation). Thus, officers will seek the degrees that will be most valuable to them. For example, in recent years, the popularity of the MBA for the civilian sector has manifested itself in the educational desires of the officer corps and many officers seeking to maximize their earning potential over the course of their careers seek MBA or equivalent degrees while in the Navy.

At the organizational level, the Navy must decide who to educate, what education to provide to them, and how they will get a return for that education. The Navy requires that an officer stay in the military for a certain amount of time upon completion of fully or partially funded education. Thus, presumably it captures the costs of providing education by ensuring the officer stays in the Navy, for the same compensation as others without education, but presumably as a more productive officer than those without education. The minimum requirement for additional obligated service is three years for the first year of full-time, fully-funded education. This policy was set by the Department of Defense in the early 1970's and has not been changed significantly since (Department of Defense, 1991). This presumes that the Defense Department has determined that it can recover, or is willing to subsidize, the cost of both the education and the associated loss of productivity of that officer while he or she is attending school, in the three years following completion of that school. In practice, most officers who receive a fully-funded graduate education remain in the Navy for a full career. Thus, the cost of the education is amortized over the course of the career.

However, as the cost of providing education for its officers increases and the demand for officers to remain in operational assignments grows, the Navy questions the value of graduate education and the time that it takes for an officer to obtain a degree

when he or she could be doing other, presumably more important things. A report by the Naval Studies Board (National Academy of Science, 1997) summed it up in this way:

> Navy needs are already highly advanced scientifically and technologically, and the importance of technical literacy among naval personnel will only increase in the future. The march of information and communication technology, sensing and display techniques, computer system capabilities, material and power options, and so forth has reduced shipboard manning requirements for routine duties and has improved warfighting strength. These technical capabilities substantially increase the Navy's need for personnel who can comprehend the potential for warfighting that the new technologies bring, who understand both the opportunities and the limitations they present, who are able to choose among competing technological avenues, who can critically assess and lead technological development, and who can formulate practicable new technological visions…Navy may not value sufficiently the problem-solving potential represented in substantive graduate programs in technology, engineering, and science.

F. PURPOSE OF THIS STUDY

The focus of this study is to explore how Master's level education increases productivity. Specifically, this study looks at officer education in the United States Navy and whether graduate education makes a better officer. In order to provide insights into this question, this study focuses on the design and validation of a survey that can be administered within the Navy. The three questions that this study answers are:

- What are the outcomes of graduate education at the Master's level?
- Can scenarios be developed to reflect the behaviors associated with the outcomes of education?
- Can a survey be designed that measures the increase in productivity due to education at the Master's level?

III. RESEARCH DESIGN

This study involves the design and validation of a survey that will provide insights into officer education in the United States Navy and whether graduate education at the Master's level makes a better, or more productive, officer.

The most straightforward way to gain information about the increase in productivity due to education is, of course, testing. However, testing is a lengthy and complex process. In the development of the College Results Survey (CRS), formerly the College Results Indicator (CRI) (Zemsky, Shapiro, and Shaman, 2001), the researchers encountered this same issue when they wanted to measure the outcomes of undergraduate education. Instead, they developed a survey, the CRS, to gain insights into this issue. In particular, the method they used to measure the domain of "abilities," was to develop a set of scenarios that graduates would find in everyday life. They then asked the respondents to indicate how prepared they were for the situation presented in each scenario. The results of the CRS provide insights into how well college graduates felt prepared to perform certain tasks, and thus insight into the abilities gained in the education process.

In considering the increase in productivity from graduate education programs for the Navy, this methodology of asking questions in the form of scenarios that equate a specific behavior to an outcome of education is one that could be both useful and cost-effective. It is difficult for officers to understand and appreciate the long-term impacts and intangible benefits of graduate education. However, if these benefits can be somehow qualified in actual behaviors, they may be easier to understand and therefore

appreciate. Additionally, officers in the military are comfortable with the notion of performance evaluations and making judgments about other officers, particularly when it comes to evaluation of specific behaviors. Peer ratings are also considered to be one of the best predictors of job performance (O'Leary et. al., 2002). In the administration of this survey, supervisors will be asked to make judgments about other officers. Thus, officers may value the results of this survey, more so than one where officers respond directly about the impact of graduate education. Thus, if the results show that there is a difference between those with and without graduate education, decision makers in the Navy will be able to more readily see the impact of graduate education on immediate job requirements as well as to the long-term success of the organization.

This study involves the development of a survey for the Navy. The survey is designed so that it can be administered to a large segment of the Navy organization. In full-scale implementation, the Commanding Officer, or other supervisor with first-hand knowledge of a large group of officers, would be asked to evaluate the officers in their organization on how well each officer would perform in each of the given scenarios. Analysis of the results would provide information on whether graduate education actually enhances the performance of officers. Comparisons could also be made for type of educational program, when the education was received, whether the education was funded by the Navy or not, and if certain educational programs had greater benefit to different types of officers, such as aviators or surface officers.

This study is a criterion validation problem. The key issue in design of this instrument is the validity of the survey, that is, whether the survey instrument measures the *real meaning* of the concept under consideration (Babbie, 1998). Criterion-related

validation compares test scores, or predictions made from them, with an external variable, or criterion, that is considered to provide a direct measure of the characteristic or behavior in question (Cronbach, 1971). A common example of criterion-related validity of the College Board as shown in its ability to predict college success of students (Babbie, 1986).

This survey is designed to provide insights into whether graduate education makes a better, or more productive, officer in the Navy. The key question is whether the survey measures productivity. In order to answer this question, we first develop a definition of productivity that is commonly accepted. In this study, the definition of productivity involves a set of competencies related to productivity. We then ensure that the survey instrument, in this case the scenarios that are developed, are related to the competencies. And, finally, we verify that the instrument is a reliable one. Each of these tasks is described in more detail in this chapter.

- Task I: Determination of the set of competencies related to productivity and the expected outcomes from graduate education
- Task II: Development of scenarios that measure the indicated competency
- Task III: Ensuring the reliability of the instrument

A. TASK I: DETERMINATION OF THE SET OF COMPETENCIES RELATED TO PRODUCTIVITY AND THE EXPECTED OUTCOMES FROM GRADUATE EDUCATION

The dependent variable for this research is productivity, specifically the productivity augmentation resulting from attainment of a Master's degree. As discussed

in Chapter II, productivity is a complex concept with many dimensions. Thus, the first part of this research involves development of the criterion and establishment that it provides a direct measure of productivity. A review and analysis of the literature pertaining to graduate education and productivity leads to the following set of competencies that are obtained from graduate education.

- **Collaboration/Teamwork:** Ability to work in groups to achieve common objectives
- **Systems Thinking/Analysis:** Think of issues from a broad perspective
- **Analytical Reasoning:** Makes decisions based on data
- **Resource Management**: Effective management of time, money and people
- **Technical Adaptability:** Understands the underlying principles of technical systems and can adapt the principles and systems for other uses
- **Communication:** Ability to make people understand ideas via a variety of media including the spoken and written word
- **Innovation/Creativity:** Ability to approach traditional circumstances and problems with a different perspective and conceive of new ways of doing things
- **Ability to Define and Solve Problems:** Correctly assesses the true nature of a problem and develops solutions

- **Research and Continuous Learning:** Appreciation for the value of research combined with a willingness and desire to learn new things and explore new ideas
- **Dealing with Complexity:** Ability to assimilate many facets of a situation or problem

The next step in this process includes validation of this list of competencies. This is accomplished by seeking expert judgment. Eight subject matter experts are asked to provide judgments about these competencies. The subject matter experts are selected from within the Naval Postgraduate School and from other organizations that have dealt with Navy education. Within the Naval Postgraduate School, the experts include academic program advisors, military officers, and faculty with expertise in educational skill assessment. External to the Naval Postgraduate School, experts in the military officer personnel system and other researchers who have extensive experience in this area are included. The panel of experts includes three active duty military officers and a fourth retired military officer, five NPS faculty members, three people who have extensive experience with military human resource management, and two who are experts in learning and cognitive skill development.

A questionnaire given to this panel of experts asks them to consider two questions about the competencies described above. The first question is whether the competency is important to the effectiveness and productivity of a Naval officer and the second is whether the expert believes that this competency is developed in graduate education programs.

B. TASK II: DEVELOPMENT OF SCENARIOS THAT MEASURE THE INDICATED COMPETENCY

The next step of this study involves development of questions that will measure the outcomes or competencies. Following the model of the College Results Indicator (CRI) (Zemsky, Shapiro, and Shaman, 2001), the goal is to develop a set of scenarios that graduates would find in everyday life that measure the competencies attained in graduate education. The initial set of scenarios is based on the researcher's understanding of each of the competencies and of "every day" life in the Navy. Each scenario is designed to relate to one outcome. However for three areas, Analytical Reasoning, Resource Management and Systems Thinking/Analysis, two scenarios are initially developed. These areas are more difficult to define and to effectively capture in a scenario.

The same panel of experts is used to verify these scenarios reflect behaviors related to the expected outcomes of education. The questionnaire provides a list of the competencies described above and then presents each scenario. The respondent is asked to choose the competency from the list that most closely describes the one that they would look for in the person they would choose to solve the problem or complete the task. The questionnaire is provided as Appendix A. The outcomes and the original scenarios are presented in Table 2.

Table 2. Outcomes and the Original Associated Scenarios.

OUTCOME	SCENARIO
Collaboration and Teamwork	You are involved in a multi-national joint operation in a foreign country. You need to send someone to serve on the coordination team to provide expertise on Naval operations.
Technical Adaptability	A contractor has just presented your organization with an update to a major weapons system. Although it worked well during its initial trials, there are now compatibility problems with other tactical systems. You need to document the problems and provide an analysis of what needs to be changed.
Analytical Reasoning	There are three pieces of intelligence information that have been provided to you. Each has a confidence factor and margin of error. You are considering whether to launch a missile and need to determine the probability of hitting the target.
Systems Thinking	You have recently been authorized to reduce the number of watchstanding positions, provided that you have sufficient personnel, either on ship, or within a designated recall time. You need to develop a new watchbill that minimizes risk and yet provides maximum time off for personnel.
Resource Management	A Congressional Committee has recommended a new retirement system to replace the existing system. It involves several options for vesting early, for deferring payment of compensation, and for taking lump-sum payments. You need to develop a system for explaining the changes to the members of your organization, and for reviewing the options for each individual.
Dealing with Complexity	A cruise missile is inbound toward your ship. You know its velocity, the velocity of your interceptor missiles, their single-shot kill probability, and your firing doctrine. You need to know the shortest range by which you must have detected the incoming missile in order to maximize your kill probability.
Resource Management	You need to determine the average daily cost of operating your organization.
Systems Thinking	You need to assess the wisdom of using wireless networks for shipboard operations, including cost, vulnerabilities, and design limitations.
Analytical Reasoning	You are tracking a diesel submarine with both shipboard and air assets. You need to design a search pattern to maximize detection probability.
Communication	Your organization has been researching and preparing a presentation on a new system for the past several months. You were supposed to do the briefing, but are unable to do so.
Innovation and Creativity	You have just received a personnel cut of 10 percent. You need to decide what functions that you will no longer do, or how you will get them for lower cost.
Ability to Define and Solve Problems	Your organization has experienced a significant loss in retention. In the past three years, you have dropped from a rate that is consistent with the Navy average, to one that is well below it. You need to assess the cause and make recommendations for change.
Research and Continuous Learning	The CNO has recently asked that every organization designate an individual to the "Learning Officer" responsible for guiding officers and enlisted in continuous learning and professional development.

Based on the results of this questionnaire, comments by the respondent and subsequent discussions with some of the respondents, the scenarios are then revised to better reflect the outcomes. Table 3 lists the final set of outcomes and the associated scenarios to be used for the testing and validation of the survey.

Table 3. Outcomes and the Final Associated Scenarios To Be Used for the Testing and Validation of the Survey.

OUTCOME	SCENARIO
Collaboration and Teamwork	Your unit is involved in a multi-national joint operation in a foreign country. You have been asked to serve on the coordination team to provide expertise on Naval operations and capabilities.
Systems Thinking/Analysis	A contractor has just presented your organization with an update to a major weapons system. Although it worked well during its initial trials, there are now compatibility problems with other tactical systems. You need to document the problems and provide an analysis of what needs to be changed to make the various systems compatible.
Analytical Reasoning	There are three pieces of intelligence information that have been provided to you. Each comes with a measure of its reliability. You are considering whether to launch a missile and need to determine the probability of hitting the target before making a recommendation on whether or not to launch the missile.
Resource Management	You need to determine the average daily cost of performing your mission based on the various activities and tasks, the number and type of personnel assigned, your operating budget and other resources.
Technical Adaptability	You need to assess whether your organization should adopt full-scale use of wireless networks for shipboard operations. Your assessment should evaluate costs, vulnerabilities, risks, security, and design limitations.
Communications	Your organization has been researching and preparing a presentation on a new system for the past several months that will be given to a set of high-ranking officers who are sure to be skeptical about the system. Your boss was supposed to do the briefing, but cannot do so. You have been asked to give it.
Innovation and Creativity	Your organization has just received a personnel cut of 10 percent. Your Commanding Officer has determined that the organization will not simply "do more with less" but that he will implement new ideas that will save money. You have been asked to provide ideas that will save money.
Ability to Define and Solve Problems	Your organization has experienced a significant loss in retention. In the past three years, you have dropped from a rate that is consistent with the Navy average, to one that is well below it. You need to assess the cause and make recommendations for change.
Research and Continuous Learning	You have been given a report on modeling and simulation of ship-shock vibration analysis in response to underwater explosions. You have been asked to find additional studies or reports that substantiate the findings of this report and evaluate their findings in light of actual trial test data.

C. TASK III: ENSURING THE RELIABILITY OF THE INSTRUMENT

The third part of the research is aimed at ensuring the reliability of the instrument. Babbie (1986) describes reliability as "a matter of whether a particular technique, applied repeatedly to the same object, would yield the same result each time." Stanley (1971)

defines reliability as "consistency from one set of measurements to another." Typically, in survey research, one way to ensure reliability is to administer the exact same survey to the same respondents after some time period has passed. However, this was not a viable option for the testing of this survey due to the time constraints on the people expected to answer the survey. An alternative design, and the one used in this survey, asks two people who are assumed to have about the same knowledge to answer the same questions. One can then look at the consistency in responses and obtain a measure of the reliability of the instrument, or the reliability coefficient. For this study, we ask both the Commanding Officer and the Executive Officer, or another person in the organization to respond to questions evaluating the same group of officers. We then compare their responses for each of the questions or scenarios. We compute a reliability coefficient for each of the scenarios, which again, are related to the different competencies.

The survey is then administered to a small number of Naval officers. I identified several Navy commands, two ships which are operational commands and two training commands. These units are selected because they have a sufficient number of officers onboard with a variety of skills and backgrounds. Yet, the organizations are not so large that the supervising officers would not be able to have first hand knowledge of the officers who work for them. Additionally, one of the ships is a participant in an innovative Navy experiment involving optimal manning. After an initial inquiry as to whether the commanding officer, and thus presumably the Executive Officer, is willing to participate in the research, I then identify a group of officers at each command to include as officers to be evaluated by the Commanding Officer and Executive Officer. The officers selected include a variety of designators and educational backgrounds.

The survey asks the respondents to evaluate each of several officers in terms of how well prepared they feel the survey respondents, including rank, designator, and educational information. The purpose officer is to perform in the given scenarios. I collect some basic demographic information from the of collecting this information is to be able to look at potential differences in responses, especially as it applies to undergraduate degree types and whether the respondent has a graduate degree. A compete copy of the survey is provided in Appendix B.

The results of the survey are then analyzed for each competency and a reliability coefficient is calculated for each individual question or competency. This reliability coefficient provides a measure of the variance that is due to differences in the officer being evaluated, rather than other factors. The set of reliability coefficients then provides a measure of the reliability of the overall survey.

IV. ANALYSIS

This chapter provides the results and analysis of each of the steps described in Chapter III.

A. TASK I: DETERMINATION OF THE SET OF COMPETENCIES RELATED TO PRODUCTIVITY AND THE EXPECTED OUTCOMES FROM GRADUATE EDUCATION

The first step in developing the survey instrument is to define the concept of productivity in terms of the expected outcomes of master's level graduate education, specifically as they apply to the Navy and to Naval Postgraduate School. Several sources are used to determine which outcomes should be considered. In addition to the literature about the outcomes of education presented in Chapter II, a survey that was developed by the Director of Training and Education, Chief of Naval Operations (N79) during the Summer of 2001 was used. This survey, although never fully implemented, was designed to be given to Navy leadership, specifically Navy Admirals, to determine what they viewed as the expected outcomes of education. The surveyed identified the following skills and abilities as both expectations of education and important to the success of naval officers.

- Advanced reasoning skills
- Analytical evaluation
- Collaboration techniques
- Communication Skills (both Oral and Written)
- Complex problem-solving
- Critical thinking
- Technical adaptability

- Innovative thinking
- Research skills
- Resource management skills
- Self-confidence
- Systems analysis

As discussed in Chapter II, the Corporate University Exchange identified that education enables a person to:

- Better think logically; deal with complexity
- Better solve problems with proven methodology
- Better conceptualize
- Better model situations toward analytical solutions
- Better create new ideas and innovative approaches

In a report that looked at the Graduate Record Examinations, or GRE, and what skills and abilities that are expected to predict success in graduate school, Powers and Enright (1986) identified the following attributes:

- Reasoning Skills
- Problem Definition
- Constructing Hypotheses or Arguments
- Analyzing Arguments
- Drawing Conclusions

As discussed in Chapter II, Oblinger and Verville (1998) describe the traits that business wants from education as:

- Successful Intelligence
- Personal Qualities and Skills
- Skills for a Flexible Organization
- Knowledge of the World of Work and Corporate Culture
- A Mix of Skills and Broad Education
- Communication
- Teamwork

- Interpersonal Skills
- Solving Problems and Making Decisions
- Creativity
- Leadership
- Project Management
- Continuous Learning
- Practical Experience

Finally, each Naval Postgraduate School program has a set of educational skill requirements that is developed by the sponsor of the program in conjunction with the Naval Postgraduate School faculty, or faculty at other universities where the program is taught. Most of the skill requirements are program and degree-specific, however, there are some that are common to all or most programs. These include communications, problem-solving, analysis, computer and information technology use, innovation and creativity, systems-thinking, and strategic thinking.

The following list of the expected outcomes of education are derived from the above studies and reports. Table 4 provides an analysis of how these outcomes are related to each of the studies or material described above.

- Technical Adaptability
- Problem definition and solving-ability
- Analytical reasoning
- Dealing with Complexity
- Systems Thinking/Analysis
- Research and Continuous Learning
- Innovation/Creativity
- Collaboration/Teamwork
- Resource Management
- Communications

Table 4. Analysis of How The Outcomes of Education Are Related to Each of the Studies or Material Described Previously.

COMPENTENCY AREA	Oblinger and Verville	Navy Study	Corporate University Exchange	Powers and Enright	Naval Postgraduate School Skill Requirements
Collaboration and Teamwork	X	X	X		X
Systems Thinking/Analysis		X			X
Analytical Reasoning		X	X	X	
Resource Management		X			
Technical Adaptability		X			X
Communications	X	X			X
Innovation and Creativity	X	X	X		X
Ability to Define and Solve Problems	X	X	X	X	X
Research and Continuous Learning	X		X		X
Dealing with Complexity			X		

In order to validate that the assumption that these outcomes are related to productivity in the Navy, and are the expected outcomes of graduate education programs for the Navy, a questionnaire was sent to several subject matter experts both in and out of the Naval Postgraduate School. Within the Naval Postgraduate School, this included academic program advisors, military officers, and faculty with expertise in educational skill assessment. External to the Naval Postgraduate School, this included experts in the military officer personnel system and other researchers who have extensive experience in this area. The questionnaire provides the list of competencies, or expected outcomes of education, and asked respondents to respond to two statements.

- This competency is important to the effectiveness and productivity of a Naval officer
- I believe that this competency is developed in graduate education programs

Respondents were asked to provide responses in accordance with a 5-step Likert Scale ranging one meaning strongly disagree to five as strongly agree. Respondents were

also given the option of stating no opinion. One of the eight respondents felt that they did not have enough knowledge to respond to the survey at all. Table 5 provides mean scores and standard deviations for each of the results of these questions for the seven respondents.

Table 5. Mean Scores and Standard Deviations for Ratings of Importance of the Competencies to Effectiveness of a Naval Officer.

IMPORTANT TO EFFECTIVENESS OF NAVAL OFFICER		
COMPETENCE	**MEAN**	**Std Dev**
Technical Adaptability	4.71	0.49
Problem Definition and Solving-Ability	5.00	0.00
Analytical Reasoning	4.43	0.53
Dealing with Complexity	4.29	0.76
Systems Thinking/Analysis	4.43	0.53
Research and Continuous Learning	4.29	0.49
Innovation/Creativity	4.43	0.53
Collaboration/Teamwork	4.86	0.38
Resource Management	4.43	0.53
Communications	4.86	0.38

As shown in Table 5, the respondents are fairly consistent in their belief that these competencies are important to the effectiveness of Naval officers. The average scores for the individuals range from low of 4.3 to a high of 5.0. All respondents strongly agree that the ability to identify and solve problems is important to the effectiveness of a naval officer. Communications and Collaboration and Teamwork are also rated very high as important to officer effectiveness.

Table 6 provides the results of the answers to the second question, that is, whether these outcomes are a product of graduate education.

Table 6. Mean Scores and Standard Deviations for Ratings of Whether the Competencies are Developed as a Result of Graduate Education.

DEVELOPED IN GRADUATE EDUCATION		
COMPETENCE	**MEAN**	**Std Dev**
Technical Adaptability	4.00	0.58
Problem Definition and Solving-Ability	4.14	1.07
Analytical Reasoning	4.29	0.49
Dealing with Complexity	3.57	0.98
Systems Thinking/Analysis	3.71	0.76
Research and Continuous Learning	4.14	0.90
Innovation/Creativity	3.43	0.98
Collaboration/Teamwork	3.57	0.53
Resource Management	2.71	0.76
Communications	3.29	0.76

As indicated in Table 6, there is not as much consistency in the opinions of the subject matter experts when it comes to the question of whether these skills are developed in graduate education. The mean scores for this question range from a low of 2.70 to a high of 4.29. The experts generally agree that "Technical Adaptability", "Problem-Definition and Solving Ability", "Analytical Reasoning" and "Research and Continuous Learning" are skills gained as part of graduate education programs. Comparing these results with those in Table 5, we see that "Problem Definition and Solving Ability" is

consistently viewed as an outcome of education. While "Analytical Reasoning" gets high marks by the panel of experts, it does not explicitly appear in all of the studies that have looked at the outcomes of education. However, it may be that this skill is an implied one in all of the studies.

In the case of "Resource Management", the average score of the subject matter experts indicates that there is not common agreement that this is an outcome of education. Similarly, it did not appear in many of the studies shown in Table 5. However, it was decided to keep this outcome in the study. It is on the Navy's list of expected outcome of education, and is included in many, but not all, of the individual program skill requirements for Naval Postgraduate School programs. For the remaining skills, the experts are at least neutral and most agree that the skills are a result of education. Of note, one expert gave low marks to all these skills as those that are obtained in graduate education programs. Due to the small sample size, those marks tended to make the averages much lower than if those scores had been excluded. Definitions of these skill sets were not provided with the initial questions, so it is possible that some of the respondents had different interpretations of these competencies.

B. TASK II: DEVELOPMENT OF SCENARIOS THAT MEASURE THE INDICATED COMPETENCY

The next step of the research involves the development of scenarios that behaviors that match each of the outcomes. These scenarios are based on the researcher's knowledge of navy life. The scenarios are modeled like the questions in the College Results Survey, as relatively straightforward scenarios, that describe some decision that must be made or task that must be accomplished. Ideas for the scenarios derive from

similar questions in the College Results Survey, performance evaluations, placement tests for educational programs, and the Graduate Review Examination studies. Additionally, Frederickson and Ward (1978) provide some insights into measures for studying creativity and problem-solving.

As described in Chapter III, an initial set of thirteen scenarios was provided to the subject matter experts in the form of a questionnaire (Appendix A). Each original scenario is designed to be related to one of these outcomes. However for three areas, Analytical Reasoning, Resource Management and Systems Thinking/Analysis, two scenarios were initially developed. It was difficult for the researcher to decide which scenario better measures the outcome, therefore, it was decided to allow the respondents to decide.

The questionnaire asks the subject matter experts to choose from the list of competencies what one most closely describes what they would look for in a person that they wanted to complete the task or make the decision. Eight subject matter experts were asked to respond. One felt that they did not have enough knowledge of Navy matters to answer the questions. Of the seven that did answer, three are active duty military officers and a fourth is a retired military officer, four are NPS faculty members, three have extensive experience with military human resource management, and two are experts in learning and cognitive skill development.

Of the thirteen original scenarios presented in the questionnaire, only one was evaluated by all respondents as relating to the same outcome. Their answer was also consistent with the outcome that the scenario was designed to measure. The “design” scenario is included in the analysis of this analysis of the scenarios. Seventy-five percent

of the experts thought another two scenarios measured the indicated outcome. For three scenarios, the experts had no consistency in their opinions of which outcome was being measured. The other scenarios had at least fifty percent of the respondents in agreement on what outcome was associated with the scenario. However, several of the experts gave a primary answer but then listed other outcomes that they felt were also related which helped in associating scenarios with outcomes. Some also made comments about the scenarios, such as whether they were realistic or why they associated a particular outcome with a scenario. These comments were extremely helpful in the next step of the process.

The scenarios were then evaluated and some were rewritten or modified slightly to ensure that they more closely matched the indicated outcome. For example, one scenario, that was meant to measure one outcome as originally designed, used the word "explain" which lead several respondents to think that it was associated with the outcome of "Communications". Additionally, a completely new scenario had to be developed for "Dealing with Complexity" as none of the original scenarios described this outcome well. The outcomes and the final set of scenarios are provided in Table 7.

Table 7. Outcomes and the Final Set of Scenarios.

OUTCOME	SCENARIO
Collaboration and Teamwork	Your unit is involved in a multi-national joint operation in a foreign country. You have been asked to serve on the coordination team to provide expertise on Naval operations and capabilities.
Systems Thinking/Analysis	A contractor has just presented your organization with an update to a major weapons system. Although it worked well during its initial trials, there are now compatibility problems with other tactical systems. You need to document the problems and provide an analysis of what needs to be changed to make the various systems compatible.
Analytical Reasoning	There are three pieces of intelligence information that have been provided to you. Each comes with a measure of its reliability. You are considering whether to launch a missile and need to determine the probability of hitting the target before making a recommendation on whether or not to launch the missile.
Resource Management	You need to determine the average daily cost of performing your mission based on the various activities and tasks, the number and type of personnel assigned, your operating budget and other resources.
Technical Adaptability	You need to assess whether your organization should adopt full-scale use of wireless networks for shipboard operations. Your assessment should evaluate costs, vulnerabilities, risks, security, and design limitations.
Communications	Your organization has been researching and preparing a presentation on a new system for the past several months that will be given to a set of high-ranking officers who are sure to be skeptical about the system. Your boss was supposed to do the briefing, but cannot do so. You have been asked to give it.
Innovation and Creativity	Your organization has just received a personnel cut of 10 percent. Your Commanding Officer has determined that the organization will not simply "do more with less" but that he will implement new ideas that will save money. You have been asked to provide ideas that will save money.
Ability to Define and Solve Problems	Your organization has experienced a significant loss in retention. In the past three years, you have dropped from a rate that is consistent with the Navy average, to one that is well below it. You need to assess the cause and make recommendations for change.
Research and Continuous Learning	You have been given a report on modeling and simulation of ship-shock vibration analysis in response to underwater explosions. You have been asked to find additional studies or reports that substantiate the findings of this report and evaluate their findings in light of actual trial test data.
Dealing with Complexity	You have been asked to identify the feasibility of a terrorist attack on your unit including both physical security and an assessment of how terrorists might employ information operations and computer network attack tools to gain an advantage.

C. TASK III: ENSURING THE RELIABILITY OF THE INSTRUMENT

The next phase of research considers the reliability of the instrument. In this case, we examine the consistency in responses from two independent sources for each of the questions. In particular, we examine the responses to each scenario from two separate respondents for each officer being evaluated. Since there are four pairs of respondents, each of which evaluates up to ten other officers, we pool the set of responses for each scenario and look at the correlation coefficient for each scenario. This provides us insight into whether each scenario is a reliable measure of the competency.

The respondents were all active duty military officers who are in leadership positions in their respective organizations. The Commanding Officers and Executive Officers responded in each case but one. Since the Executive Officers on one of the ships had just recently arrived onboard, the Commanding Officer asked the Operations Officer who is the next most senior person onboard to respond to the survey. The respondents included six Navy Captains, one Marine Corps Colonel, and one Navy Lieutenant Commander. Two respondents are female. Six have Master's degrees, four of them from the Naval Postgraduate School.

Table 8 lists the competency, scenario, the correlation coefficient and associated r-square (r^2) for that scenario. These correlation coefficients provide insight into the reliability of the survey questions. The greater the correlation, the more that similar respondents answer the same question in the same way. Thus, the variability in the answers is more likely associated with the criterion being measured, in this case the underlying competency.

As shown in Table 8, four of the ten scenarios have correlation coefficients of 0.5 or higher. Thus, there appears to be a relatively strong linear relationship between these two variables for these scenarios. Thus, there is evidence that the scenarios for those competencies, "Collaboration and Teamwork", "Resource Management", "Innovation and Creativity" and the "Ability to Define and Solve Problems" are reliable measures of those competencies.

For three of the remaining scenarios, there is some evidence of correlation in the responses, although not as strong. These correlation coefficients are in the range of 0.34 to 0.47. The coefficient for the scenario related to "Communications" is 0.47 and for "Analytical Reasoning" is 0.43. This again provides some relatively strong evidence that this scenario is a reasonably reliable measure of competency. For "Systems Thinking/Analysis," there is less evidence of the reliability of that scenario as the coefficient is 0.34.

For the remaining three scenarios, the correlation coefficients are low, below 0.22, showing little evidence of correlation in the responses. However, upon an analysis of the data, in each of these cases, one single respondent provided all low answers to the question, indicating that they felt the officers they were evaluating were not prepared to make this particular decision. However, there is still no indication of reliability for these scenarios as related to "Technical Adaptability", "Research and Continuous Learning" and "Dealing with Complexity."

In a related measure of the reliability of the survey questions, the r^2 figures measure the amount of common variance shared by the two variables. So, for the "Collaboration and Teamwork", "Resource Management", "Innovation and Creativity"

and “Ability to Define and Solve Problems” scenarios, 25 percent or more of the variance is due to the differences in answers between the two sets of respondents. There is only slightly less variance attributable to those differences for the scenarios related to “Analytical Reasoning” and “Communications”. For the remaining scenarios, less than 11 percent of variance is accounted for due to the differences in respondents. Thus, in all cases, there are other factors that contribute to the differences in the responses. Some of the possible factors will be discussed in Chapter V.

Table 8. Competency, Scenario, the Correlation Coefficient and Associated r-square (r^2).

OUTCOME	SCENARIO	CORRELATION COEFFICIENT	R2
Collaboration and Teamwork	Your unit is involved in a multi-national joint operation in a foreign country. You have been asked to serve on the coordination team to provide expertise on Naval operations and capabilities.	0.5	0.25
Systems Thinking/Analysis	A contractor has just presented your organization with an update to a major weapons system. Although it worked well during its initial trials, there are now compatibility problems with other tactical systems. You need to document the problems and provide an analysis of what needs to be changed to make the various systems compatible.	0.34	0.11
Analytical Reasoning	There are three pieces of intelligence information that have been provided to you. Each comes with a measure of its reliability. You are considering whether to launch a missile and need to determine the probability of hitting the target before making a recommendation on whether or not to launch the missile.	0.43	0.18
Resource Management	You need to determine the average daily cost of performing your mission based on the various activities and tasks, the number and type of personnel assigned, your operating budget and other resources.	0.51	0.26
Technical Adaptability	You need to assess whether your organization should adopt full-scale use of wireless networks for shipboard operations. Your assessment should evaluate costs, vulnerabilities, risks, security, and design limitations.	0.22	0.05
Communications	Your organization has been researching and preparing a presentation on a new system for the past several months that will be given to a set of high-ranking officers who are sure to be skeptical about the system. Your boss was supposed to do the briefing, but cannot do so. You have been asked to give it.	0.47	0.22
Innovation and Creativity	Your organization has just received a personnel cut of 10 percent. Your Commanding Officer has determined that the organization will not simply "do more with less" but that he will implement new ideas that will save money. You have been asked to provide ideas that will save money.	0.5	0.26

V. CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE STUDY

This research provides insights into the value of graduate level education, specifically at the Master's level. Its purpose is to develop a survey that can provide evidence about whether Master's level education makes a better, or more productive, officer in the United States Navy. The study accomplishes its purpose through the development of a survey instrument that can be used to measure the perception of supervisors about performance of officers. However, it is recommended that the survey be further refined before it is administered. It can then provide insights into whether officers with or without graduate education perform better over a series of scenarios.

The development of this survey was accomplished in a three-phased approach. First, research on the outcomes of graduate education is used to produce a set of outcomes that are validated to be both important to the productivity of an officer and obtained in graduate education. Then, these outcomes are translated into a set of scenarios that are related to behaviors that demonstrate each competency. Finally, the scenarios, in the form of a survey, are tested for reliability. The result of this research is a survey instrument that should be further tested and developed prior to implementation.

A. LIMITATIONS OF THE STUDY

As with any study, there are clearly limitations in each phase of the research. As discussed in Chapter 2, although there is much that has been written about the outcomes of education up to the point of undergraduate degrees, and some at the doctorate level, little has been written specifically about education at the Master's level. This may

change in years to come as more and more professionals, and professional communities, begin to demand at least a Master's degree as a requirement that demonstrates a certain level of competence and proficiency in a field. However, at the time of this study, the literature and research that is available provides only limited understanding of the expected outcomes of education at the Master's degree level.

Once the outcomes were decided upon, this study uses the expertise of several people who are knowledgeable about, and active in, the field of education, both within and outside the Navy. Eight experts were consulted and seven responded. It would be useful, and insightful, to use a larger panel of experts, perhaps with a wider range of expertise, to verify the outcomes of education, their evaluation about what competencies contribute to productivity of an officer, and whether the skills are gained as a result of education.

These experts were only asked to comment on a given list of outcomes. There was no opportunity for the experts to add to the list of outcomes. Future studies may want to use a more iterative process in which the experts are asked to evaluate the importance of a set of competencies and then allow them to add to the list. Then, the complete list could be revalidated by the experts. This may produce a more comprehensive list of the outcomes of education.

In a related consideration, although the study indicated that the list of competencies discussed are valid of outcomes of education, it is not clear that it is a sufficient list to describe what makes a productive officer. That is, the study shows that these competencies are all elements of productivity, yet it is not clear that they fully describe what makes a productive officer.

The next phase of this research, the development of the scenarios, also has limitations that could be addressed in future studies. As the same panel of experts was used in this part of the research, this phase would benefit from using a larger panel in similar ways as those described above.

Additionally, the development of the scenarios is a complex process. Single word changes in a scenario can dramatically change the skill demonstrated by the scenario and thus, the underlying competency being measured by the question. It would be useful to test the scenarios each time any significant change is made to a scenario, in order to validate that the change achieved the desired result. Ideally, the process would continue until there was clear agreement that each scenario was related to one competency or skill. One thing that may facilitate this process is to provide definitions or descriptions of the outcome with the scenarios. It may be that different respondents defined the competencies in different ways. In this study, a new scenario had to be developed for one of the competencies following the panel of experts review as the panel did not indicate that the original scenario measured the competency in a meaningful way. Further testing of the scenarios could result in a better set of scenarios.

As with any assessment instrument, it is always useful to have more than one measure of any single attribute. This survey, as designed, has a one for one match with scenarios and competencies. A more robust design might include more than one scenario for each competency. Alternately, it may be possible to design scenarios that would demonstrate mastery of more than one skill. This, however, is a far more complex process and would require substantial testing and validation. A third design might include a set of scenarios for each competency, with only one scenario chosen each time

the survey is administered. This design could be useful if the survey is to be given more than once to the same respondents, for example, if the Navy were to adopt this survey for use as a periodic assessment tool.

B. NEXT STEPS

This survey, when further developed as described above, could be used by the United States Navy to gain insights into the value of graduate education for their officer corps. The instrument is designed for a certain subset of the Navy, that is, the officers in the operational communities of the Navy. Clearly, other parts of the Navy, such as the engineers, doctors, or even the supply corps who are the business managers of the Navy, would require a different set of behaviors than presented in these scenarios, even in some cases to demonstrate mastery of the same competencies. However, it is the operational communities that struggle with the determination of whether or not to provide graduate education for their members. The Navy would therefore need to choose how to best administer this survey. It could develop different surveys for the different communities, or it could choose to only administer the survey to the operational communities. Either way, it may be useful to develop a more complete set of scenarios, and to test the scenarios more fully.

It is possible that the outcomes of graduate education described in this research are very similar to the outcomes that are expected of someone with an undergraduate degree. Thus, further education may simply increase the capacity in that skill set, rather than provide new skills. In order to further validate the scenarios, and to ensure that they measure learning beyond that which occurs at the undergraduate level, an initial testing of the scenarios was conducted using students enrolled at the Naval Postgraduate School.

This part of the research is an attempt to look at the "learning gain" as described by Byrk, Thum et al. (1998). We assume that the graduate education experience provides some "learning gain" to each individual that results in an increase in expected productivity for the Navy. This increase in productivity might be measured by asking students at the beginning and end of their graduate education how prepared they felt to make the decisions or complete the tasks set out in the scenarios.

Fifty-six Navy officers students at the Naval Postgraduate School were asked to complete a survey (Appendix C). This was the entire population of Navy officers enrolled in either their first quarter or one of the last two quarters of their graduate program. Of note, Navy policy assures that it is reasonable to assume that the set of navy officers starting a graduate education program at the Naval Postgraduate School have the same general characteristics in terms of experiences prior to graduate school, designator, gender and other characteristics as those that started their programs within the last two years and are now ready to graduate. We can then look at that "learning gain" by asking these students to respond to the same set of scenarios developed for this survey.

There were 26 in the group of new students and 30 in the group of graduating students. The response rates were 65 percent for the first group and 76 percent for the second. Table 9 provides the mean and standard deviation of the scores for each of the scenarios (labeled 1- 10) for the group as a whole, for the graduating students and for the new students.

Table 9. Mean and Standard Deviation of the Scores for each of the Outcomes and Related Scenarios for the Group as a Whole, for the Graduating Students and for the New Students.

	ALL		NEW		GRADUATING	
Competency	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**
Collaboration and Teamwork	3.62	0.92	3.53	0.92	3.68	0.95
Systems Thinking/Analysis	3.59	0.93	3.27	1.10	3.82	0.73
Analytical Reasoning	3.60	1.03	3.07	1.28	4.00	0.56
Resource Management	3.51	1.01	3.29	1.07	3.67	0.97
Technical Adaptability	3.41	1.09	2.87	0.99	3.77	1.02
Communications	4.03	0.93	3.53	1.06	4.36	0.66
Innovation and Creativity	4.11	0.70	3.60	0.63	4.45	0.51
Ability to Define and Solve Problems	4.16	0.69	3.93	0.70	4.32	0.65
Research and Continuous Learning	3.49	1.04	3.07	1.03	3.77	0.97
Dealing with Complexity	3.51	1.04	3.33	1.05	3.64	1.05

In order to determine if there are differences in the responses of the new students as compared with the graduating students, t-test statistics are computed for each of the questions. As shown in Table 9, for seven of the ten scenarios, the differences between the graduating and the new students is statistically significant at the 0.05 level. The statistics for the remaining scenarios are not significant. These scenarios should therefore be subjected to additional analysis.

Table 10. Student's T-Test Statistic Comparing New and Graduating Students.

Competency	Student's T-Test Statistic Comparing New and Graduating Students
Collaboration and Teamwork	0.32
Systems Thinking/Analysis	0.04
Analytical Reasoning	0.00
Resource Management	0.14
Technical Adaptability	0.01
Communications	0.00
Innovation and Creativity	0.00
Ability to Define and Solve Problems	0.05
Research and Continuous Learning	0.02
Dealing with Complexity	0.20

D. CONCLUSIONS AND CHALLENGES

The inspiration for this study came from two sources. The first is from a desire to answer the question for the Navy of what value they get from providing education to their officer corps. This is a question that the Navy struggles with, and the Naval Postgraduate School has sought to answer in several different ways. In particular, it would be desirable to know what educational programs or degrees provide the greatest contribution to productivity so that the Navy would know how to best invest the scarce resources devoted to graduate education. The second source of inspiration was an article on the College Results Indicator, now called the College Results Survey, as it provided insight into how this question might be answered for the Navy. The idea that one could answer the first question for the Navy in a meaningful way, with results that the Navy could understand and would appreciate, by adopting the scenario format presented in the College Results Survey was appealing.

As evidenced in the small survey of officers in the beginning and the end of their educational programs, there seems to be merit in the idea that these scenarios represent

skills gained in a graduate education program. Those finishing their degree program felt more prepared and capable of performing the tasks or making the decision. This may also indicate that higher education provides graduates with greater confidence in their own ability to solve difficult problems or perform challenging tasks. The interaction between actual skills gained and confidence is one that could be further explored.

This type of instrument, one that tries to provide a link between the expected outcomes of education and behaviors that demonstrate those outcomes, may also hold a significant place in the assessment movement that continues to grow in higher education. As universities and consumers alike look to find tangible evidence of the returns due to more education, it may be useful to adopt instruments like this one. This survey provides a measure of productivity that goes beyond salary. And, in that sense, it can provide insights into why people with more education earn higher salaries. Surveys like this one can describe what a person can do, and how they can bring a greater level of productivity to an organization. As the pace of change in all fields accelerates due to information technology and globalization, it will become more and more important for organizations to understand what types of skills they need, and where they might attain those skills. It will also be important for universities to understand how, and how well, their educational programs provide those skills.

There are many challenges still to resolve however. One challenge is to determine whether it is have assessment tools that allow assessment across a wide spectrum of educational programs from different universities. It may be that the different professional societies and business communities may need to develop instruments tailored for their career fields. Another challenge is the development of instruments that have questions

that are related to current behaviors, but that are timeless enough to be used to show progress over time. There could be attempts to "teach to the test" as universities, and the graduates they produce, realize the specific skill sets that are needed and begin to value those specific skills over the education that allows a person to perform those skills as well as many others. If this were to happen, in the long term, this could have a negative impact on the economic and social returns to education to both the individual and to the public sector.

Another significant challenge is the development of instruments that measure the contribution of education to success or productivity. Specifically, the instrument needs to capture the gains in productivity due to the most recent educational experience, rather than either education at the undergraduate level or the experience gained after that education. Surveys administered before and after educational programs can provide some assurance that the gains are related to the educational experiences.

Despite these challenges, there is much to be gained from this research on this assessment tool. For Navy leadership, which often struggles with the question of whether education provides specific skills that make Naval officers more productive, or whether it is provides only more general returns, such as those that accrue to society as a whole and to the individual who receives the education, this survey can provide a direct answer. Since the Navy values the outcomes of education as described in this dissertation, and these outcomes contribute to the effectiveness of Naval leadership, administration of the survey to Naval officers, can provide a qualification of the benefits that accrue directly to the Navy. This knowledge would allow the Navy to make better decisions about how to spend its resources devoted to education. They would know what programs provide the

best return on the investment. This research could also provide some measure of the increase in intellectual capacity that education provides.

For the Naval Postgraduate School, this could also be an important tool in its outcomes assessment portfolio. The Naval Postgraduate School's mission is to increase the combat effectiveness of the Navy and Defense organizations. The link between the education that Naval Postgraduate School provides and combat effectiveness is one that is difficult to understand, let alone measure. The scenarios developed as part of this research, make that link much clearer. The Naval Postgraduate School could use the results of the Navy's administration of this survey to quantify and explain that link. Additionally, the Naval Postgraduate School, could use the survey results to evaluate its various degree programs and how well they contribute to combat effectiveness.

Thus, as described above, this dissertation contributes to the overall literature on assessment of the outcomes of higher education. It also provides a framework for development of a valuable tool that can be used by both the Navy and the Naval Postgraduate School.

APPENDIX A. QUESTIONNAIRE

PART I: EXPECTED OUTCOMES OF GRADUATE EDUCATION

Based on a review and analysis of research on higher education, the following list of the expected outcomes of graduate education has been developed. They represent a set of skills or competencies that are expected to be attained as a result of the completion of a graduate program.

Please indicate how well you agree with the following statements for each competency.

This competency is important to the effectiveness and productivity of a Naval officer.

I believe that this competency is developed in graduate education programs.

0- No opinion
1- Strongly disagree
2- Disagree
3- Neutral
4- Agree
5- Strongly agree

Competency	**Important to Effectiveness**	**Developed in Grad Ed**
Technical Adaptability		
Problem Definition and Solving-Ability		
Analytical Reasoning		
Dealing with Complexity		
Systems Thinking/Analysis		
Research and Continuous Learning		
Innovation/Creativity		
Collaboration/Teamwork		
Resource Management		
Communications		

PART II: SCENARIOS TO MEASURE THE EXPECTED OUTCOMES

Imagine that you are the commanding officer of an organization and you need to choose a person to solve the problem or complete the task described in each scenario. Please indicate the competency from this list of expected outcomes of higher education that most closely describes the one that you would look for in the person that you would choose to solve the problem or complete the task.

Additionally, if you have any general comments on the scenario, please provide them as you wish.

Technical Adaptability
Problem Definition and Solving-Ability
Analytical Reasoning
Dealing with Complexity
Systems Thinking/Analysis
Research and Continuous Learning
Innovation/Creativity
Collaboration/Teamwork
Resource Management
Communications

SCENARIOS

1. You are involved in a multi-national joint operation in a foreign country. You need to send someone to serve on the coordination team to provide expertise on Naval operations.

Outcome/Skill:

2. A contractor has just presented your organization with an update to a major weapons system. Although it worked well during its initial trials, there are now compatibility problems with other tactical systems. You need to document the problems and provide an analysis of what needs to be changed.

Outcome/Skill:

3. There are three pieces of intelligence information that have been provided to you. Each has a confidence factor and margin of error. You are considering whether to launch a missile and need to determine the probability of hitting the target.

Outcome/Skill:

4. You have recently been authorized to reduce the number of watchstanding positions, provided that you have sufficient personnel, either on ship, or within a designated recall time. You need to develop a new watchbill that minimizes risk and yet provides maximum time off for personnel.

Outcome/Skill:

5. A Congressional Committee has recommended a new retirement system to replace the existing system. It involves several options for vesting early, for deferring payment of compensation, and for taking lump-sum payments. You need to develop a system for explaining the changes to the members of your organization, and for reviewing the options for each individual.

Outcome/Skill:

6. A cruise missile is inbound toward your ship. You know its velocity, the velocity of your interceptor missiles, their single-shot kill probability, and your firing doctrine. You need to know the shortest range by which you must have detected the incoming missile in order to maximize your kill probability.

Outcome/Skill:

7. You need to determine the average daily cost of operating your organization.

Outcome/Skill:

8. You need to assess the wisdom of using wireless networks for shipboard operations, including cost, vulnerabilities, and design limitations.

Outcome/Skill:

9. You are tracking a diesel submarine with both shipboard and air assets. You need to design a search pattern to maximize detection probability.

Outcome/Skill:

10. Your organization has been researching and preparing a presentation on a new system for the past several months. You were supposed to do the briefing, but are unable to do so.

Outcome/Skill:

11. You have just received a personnel cut of 10 percent. You need to decide what functions that you will no longer do, or how you will get them for lower cost.

Outcome/Skill:

12. Your organization has experienced a significant loss in retention. In the past three years, you have dropped from a rate that is consistent with the Navy average, to one that is well below it. You need to assess the cause and make recommendations for change.

Outcome/Skill:

13. The CNO has recently asked that every organization designate an individual to the "Learning Officer" responsible for guiding officers and enlisted in continuous learning and professional development.

Outcome/Skill:

Thank you for your time, consideration and support in this matter. If you have any questions or would like more information, please phone me at (831) 656-3564 or e-mail me at Jfilizetti@nps.navy.mil. You can either print and fax the answers to these questions back to me at (831) 656-3238 or send them via e-mail.

APPENDIX B. OFFICERS

RESPONDENT NUMBER (Provided in Email)	
Designator	
Rank	
Undergaduate University	
Undergraduate Major/Degree	
Date of Undergraduate Degree	
Do you already have a Master's degree (Yes/No)	
If so, please provide University, Degree and Graduation Date	

This survey consists of 10 questions that are in the form of scenarios. For each scenario, please indicate how prepared you think the officer named above is to perform the given task using the following scale of 0 - 5. To be prepared means that the officer has the knowledge, skills and tools to perform the given task. It is understood that Naval officers, in general,will perform to the best of their ability no matter what the task. This survey is asking whether you think they have the right skill sets to accomplish the task.

0	No opinion
1	Not at all prepared
2	Not prepared
3	Neutral
4	Prepared
5	Very prepared

	Officer 1	Officer 2	Officer 3	Officer 4	Officer 5	Officer 6	Officer 7	Officer 8	Officer 9	Officer 10
Your unit is involved in a multi-national joint operation in a foreign country. You have been asked to serve on the coordination team to provide expertise on Naval operations and capabilities.										
A contractor has just presented your organization with an update to a major weapons system. Although it worked well during its initial trials, there are now compatibility problems with other tactical systems. You need to document the problems and provide an analysis of what needs to be changed to make the various systems compatible.										
There are three pieces of intelligence information that have been provided to you. Each comes with a measure of its reliability. You are considering whether to launch a missile and need to determine the probability of hitting the target before making a recommendation on whether or not to launch the missile.										
You need to determine the average daily cost of performing your mission based on the various activities and tasks, the number and type of personnel assigned, your operating budget and other resources.										

You need to assess whether your organization should adopt full-scale use of wireless networks for shipboard operations. Your assessment should evaluate costs, vulnerabilities, risks, security, and design limitations.										
Your organization has been researching and preparing a presentation on a new system for the past several months that will be given to a set of high-ranking officers who are sure to be skeptical about the system. Your boss was supposed to do the briefing, but cannot do so. You have been asked to give it.										
Your organization has just received a personnel cut of 10 percent. Your Commanding Officer has determined that the organization will not simply "do more with less" but that he will implement new ideas that will save money. You have been asked to provide ideas that will save money.										
Your organization has experienced a significant loss in retention. In the past three years, you have dropped from a rate that is consistent with the Navy average, to one that is well below it. You need to assess the cause and make recommendations for change.										
You have been given a report on modeling and simulation of ship-shock vibration analysis in response to underwater explosions. You have been asked to find additional studies or reports that substantiate the findings of this report and evaluate their findings in light of actual trial test data.										
You have been asked to identify the feasibility of a terrorist attack on your unit including both physical security and an assessment of how terrorists might employ information operations and computer network attack tools to gain an advantage.										

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APPENDIX C. STUDENTS

RESPONDENT NUMBER (Provided in Email)	
Designator	
Rank	
NPS Curriculum (3 Digit Code)	
Number of quarters completed at NPS	
Expected NPS Graduation Date (Month, Year)	
Undergaduate University	
Undergraduate Major/Degree	
Date of Undergraduate Degree	
Do you already have a Master's degree (Yes/No)	
If so, please provide University, Degree and Graduation Date	

This part of the survey consists of 10 questions that are in the form of scenarios. For each scenario, please indicate how qualified you feel to perform the given task using the following scale of 0 - 5. To feel qualified means that you believe that you have the knowledge, skills and tools to perform the given task.

	No opinion	I do not feel at all qualified.	I do not feel qualified.	Neutral	I feel qualified.	I feel strongly qualified.
	0	1	2	3	4	5
Your unit is involved in a multi-national joint operation in a foreign country. You have been asked to serve on the coordination team to provide expertise on Naval operations and capabilities.						
A contractor has just presented your organization with an update to a major weapons system. Although it worked well during its initial trials, there are now compatibility problems with other tactical systems. You need to document the problems and provide an analysis of what needs to be changed to make the various systems compatible.						
There are three pieces of intelligence information that have been provided to you. Each comes with a measure of its reliability. You are considering whether to launch a missile and need to determine the probability of hitting the target before making a recommendation on whether or not to launch the missile.						
You need to determine the average daily cost of performing your mission based on the various activities and tasks, the number and type of personnel assigned, your operating budget and other resources.						
You need to assess whether your organization should adopt full-scale use of wireless networks for shipboard operations. Your assessment should evaluate costs, vulnerabilities, risks, security, and design limitations.						
Your organization has been researching and preparing a presentation on a new system for the past several months that will be given to a set of high-ranking officers who are sure to be skeptical about the system. Your boss was supposed to do the briefing, but cannot do so. You have been asked to give it.						

Your organization has just received a personnel cut of 10 percent. Your Commanding Officer has determined that the organization will not simply "do more with less" but that he will implement new ideas that will save money. You have been asked to provide ideas that will save money.						
Your organization has experienced a significant loss in retention. In the past three years, you have dropped from a rate that is consistent with the Navy average, to one that is well below it. You need to assess the cause and make recommendations for change.						
You have been given a report on modeling and simulation of ship-shock vibration analysis in response to underwater explosions. You have been asked to find additional studies or reports that substantiate the findings of this report and evaluate their findings in light of actual trial test data.						
You have been asked to identify the feasibility of a terrorist attack on your unit including both physical security and an assessment of how terrorists might employ information operations and computer network attack tools to gain an advantage.						

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