



Measuring The True Business Impact of Training

Introduction

In today's era of cost-cutting and competitive economic pressure, management needs to justify all corporate expenditures, including investments in 'soft' business initiatives, such as training, mentoring, employee benefits and marketing. These areas have long been an area of business investment for which there has been no sure way to measure impact, even as the investments in these initiatives are greater than ever.

Employee training alone has accounted for between 2% to 10% of payroll for many American companies. Many companies attempt to measure return on investment (ROI) on these initiatives but these measurements are often based on surveys and assumptions, approaches that lack an accurate basis and therefore cannot produce accurate ROI data. The sophisticated Human Resources or Marketing Department has long been looking for a way to link their training and marketing efforts to precise financial metrics, which can then be connected to business strategies, division initiatives, and bottom line profits. When this ROI measurement is available, management has a financial understanding of precisely how various soft business initiatives support the corporate mission.

HumanCapitalR_x is a software solution that statistically measures ROI on 'soft' business initiatives, such as training, marketing and promotional incentives, new technologies, employee benefits, and mentoring, among others, to provide executives with the information they need to determine the value of these initiatives. HumanCapitalR_x also goes to another level of predictive measurement, 'Optimization,' to identify the participants who benefit most from investments. With this information, the company can deploy its future initiatives to the group(s) that benefit most.

This White Paper summarizes the key issues that companies have faced in developing an effective ROI methodology for 'soft' business initiatives. It describes various ROI methodologies in current use, particularly for employee training, and how HumanCapitalR_x extends and improves upon these methodologies. The science behind the product and an overview of how it operates is presented. Finally, several case studies are presented in the Appendix to show how HumanCapitalR_x has been used to benefit actual clients.

Existing ROI Methodologies

HumanCapitalR_x® was conceived as a much-needed improvement to the “Return-On-Investment” (ROI) philosophies that have become so widespread in modern business. Methodologies such as Kilpatrick’s 4-Level Scale¹, Jack Phillip’s Return on Investment², Total Cost of Ownership (TCO)³, and trend-line analysis⁴ have been used to measure and compare training and other corporate initiatives. All of these tools, however, are based on non-scientific assessments, which cannot produce accurate ROI information to truly calculate the ROI of a ‘soft’ business initiative.

In the world of employee training, the three most prevalent methodologies which have been used in an attempt to measure ROI are the Phillips/Kirkpatrick ROI approaches, trend-line analysis, and control groups.

Phillip’s ROI approach, generally considered the most advanced of the above, is deficient in a crucial respect – their standard method relies principally on asking participants to guess at the financial benefit they received from training.⁵ It does not require a scientific assessment of that impact. As a result, estimations from surveys form the basis for their calculations of financial benefits. Relying on a set of trainee estimates is problematic as a means of accurately calculating ROI.

Psychology literature is replete with examples of numerous methodological problems associated with survey questionnaires, including the following:⁶

- Participants typically respond more positively to surveys when the same person who conducted the training, facilitated the workshop, or led the project team gives the survey to them.
- The rate of return of surveys is usually low. Those who do return the surveys may be highly motivated or very conscientious individuals and therefore may not be representative of the rest of the group.
- Participants often misremember important information when filling out questionnaires, such as whether an event occurred before or after the

1 Kilpatrick, D.L., (1975) “Techniques for Evaluating Training Programs,” in Evaluation Training Programs, Alexandria, VA: American Society for Training and Development, pp. 1-17.

2 Phillips, Jack J. (1997) Return on Investment in Training and Performance Improvement Programs. Gulf Publishing Company, Houston, Texas.

3 Naumann, Earl; Jackson, Donald W. (2000) One More Time: How do you satisfy customers? *Business Horizons* 42.3 p. 71-76. Online. FirstSearch. Periodical Abstracts. 0007-6813.12 February 2000.

4 For an example of products which use this approach, see <http://www.sr-analyst.com/>.

5 The Phillips approach certainly does not prohibit the use of solid statistical methodology. An excellent example of a Phillips-style approach with solid statistical methodology can be found in “Measuring ROI for Telephonic Customer Service Skills”, David J. Keuler. In *Eleven Case studies from the real world of training*, Volume 3 of Measuring Return on Investment Series. Patricia Pulliam Phillips, Editor, 2001. ASTD Press, Alexandria, VA.

6 Sudman, Seymour, and Bradburn, Norman M. (1982) *Asking Questions: A Practical Guide to Questionnaire Design.*, Jossen-Bass, Inc. San Francisco, CA. p.32

training.

- Various aspects of survey design, such as question order, the scale used in a question⁷, and subtle changes in the wording of a questionnaire⁸ all can strongly affect results.

All of these factors contribute to inaccurate information -- not a sound financial basis to link training to precise financial metrics that can then be connected to business strategies, line-of-business issues and bottom line corporate profits.

Trend line analysis has often been used as a simple way to capture trends over time when there is no control group to provide a benchmark. Trend line analysis suffers from numerous drawbacks as a means of measuring true ROI on 'soft' business initiatives.

First, trend line analysis by itself produces no direct evidence of statistical significance. As a result, many companies have inserted training data into their trend lines and have drawn ROI conclusions from that data.

Second, the trend-line analysis technique ignores the impact of other time-related events on the distribution of points on the trend line.⁹ The divergence from the trend line may be affected by sales cycles, natural economic increase, stock market conditions, weather, or any of a host of other factors, but the trend line analysis technique does not include a tool to measure these events and factor their impact.

Third, trend line analyses are almost never done under laboratory-controlled environments where any change can be definitely attributed to the initiative – indeed, a proper scientific analysis would require a control group even under laboratory-controlled circumstances. For that reason, trend line analysis should not be used to measure ROI if more scientifically valid methods are possible, and the conclusions developed by trend-line should be discounted under most circumstances.

Control Group methodology measures ROI by using a pilot program to introduce training, statistically testing the effect of training. Employees are randomly chosen for the training and then both trained and untrained employees are compared using a common metric and a statistical technique.

Use of control group techniques and the necessary analysis methods are certainly not unknown in corporate America,¹⁰ but most of the published ROI literature, (presumably

⁷ Shaw., A. and Others. Conceptualization and Measurement of Health for Adults in the Health Insurance Study. Vol. 3: *Mental Health*. Santa Monica, California. Rand, 1978.

⁸ Belson, W.A., Millerson, B.L., and Diccott, P.J. *The Development of a Procedure for Eliciting Information from Boys About The Nature and Extent of Their Stealing*. London: Survey Research Centre, London School of Economics and Political Science, 1968

⁹ HumanCapitalR_x studies have provided examples where overall metric performance was down for a year following training; however, this was due to trained participants performing roughly the same as in prior years, while performance of untrained participants were sharply down. This important difference would have been lost in a trend-line analysis

¹⁰ Keuler, David J. (2001) Measuring ROI for Telephonic Customer Service Skills. In *In Action: Measuring Return on Investment*, Vol. 3. Jack J. Phillips, Series Editor; Patricia Pulliam Phillips, Editor. American Society for Training and Development, Alexandria VA. p. 131 – 158.

some of the better ROI work done), largely neglects or misuses statistical or scientific techniques. This is not surprising, as these more advanced techniques tend to be well known only within academic and scientific circles.

In addition, it may be difficult or impossible within a given company for a single person to implement such a study. The largest barrier seems to be the selection of employees for training or other initiatives. Training is sometimes available for “open” enrollment by employees, and at times based on the request by a manager, who may view training as a perk for high performing employees, or a spur for poorly performing employees. A combination of these situations often occurs within large organizations. Therefore, the selection criteria alone can represent a major problem in the success of a control group study

None of these current methodologies addresses the next step in calculating ROI, i.e. determining which groups within the organization gained the most or least from an initiative (what we refer to as ‘Optimization’.)

The HumanCapitalR_x Approach

HumanCapitalR_x was created to address these problems, and provide large organizations with simple tool to assess and optimize the impact of a business -- without requiring the client to establish a regimen to adhere to scientific methods or for them to be a mathematical savant. HumanCapitalR_x software imports corporate data and forms it into General Linear Models – a “best-in-class” statistical approach. The results are statistically validated ROI and an analysis that pinpoints the groups that benefited most from the initiative. Future initiatives can be targeted to these groups for even greater ROI.

HumanCapitalR_x implements a three-step process to produce accurate ROI on ‘soft’ business initiatives. HumanCapitalR_x methodology is radically different from the current methodologies in the first two steps.

- 1.** HumanCapitalR_x uses a scientific process to gather and analyze data to statistically measure ROI.
 - A.** First, HumanCapitalR_x uses the client’s existing data such as sales commissions, customer satisfaction ratings, number of work projects handled, etc. as the measurement of the ROI. This is accomplished using a desktop application that extracts information from Excel Spreadsheets and other sources, and prompts the user to enter information to validate and describe the data. This data becomes the key metrics HumanCapitalR_x uses to measure the effect of the business initiative. As a result, ROI is truly based on data, not assumptions, making it information you can depend on to make

recommendations and decisions regarding future investments in similar initiatives. Also, it's client data, not an industry 'benchmark', so the measurement, as well as the results, are expressed in terms important to the client. Finally, HumanCapitalR_x saves the client time (and expense) since surveys no longer have to be distributed, returned, and tabulated.

B. HumanCapitalR_x identifies a control group of people who do not participate in the business initiative. Having a control group allows HumanCapitalR_x to measure the true impact of the business initiative, because this method factors out the common events that affect both groups, such as a new compensation package, new product line, new equipment, and local and national events. Time is automatically included in HumanCapitalR_x models. This allows HumanCapitalR_x to account for trends that affect both groups in the model such as an election or a recession. HumanCapitalR_x uses, as the control group, both people who never get the initiative, and those who haven't yet received it. This gives more data and also allows HumanCapitalR_x to work in situations where everyone will eventually receive the initiative but the company still wants to measure ROI.

C. HumanCapitalR_x examines prior performance – the baseline level at which each participant was operating prior to the programs being start. Prior performance is a dominant factor in measuring someone's current performance. By including prior performance, HumanCapitalR_x adjusts for the inherent bias in the selection of participants in the initiative. Change over time in a person's performance is the essence of truly measuring the ROI.

2. HumanCapitalR_x performs a well-founded and thorough statistical analysis to determine the impact of the initiative and how this impact can be optimized for future benefit.

3. HumanCapitalR_x software allows the user to generate reports and graphs that clearly show results with their financial implications, and allows a clear plan for future improvement. HumanCapitalR_x typically deliver results within 4-6 weeks from the time of data collection in a business format (web interface or Adobe Acrobat (pdf) files) that minimizes the need for mathematical expertise in the client organization.

The Science Behind HumanCapitalR_x ROI

The HumanCapitalR_x approach is to use the best mathematical models and techniques available to us, tempered with our business experience, to treat any corporate initiative as an observational study. The HumanCapitalR_x approach grew out of a field called observational statistics.¹¹ Observational statistics are used to investigate questions where random assignments and laboratory controls are infeasible or unethical, for example, studies investigating the causes of cancer¹², school choice¹³, job performance¹⁴, or smoking¹⁵. The basic philosophy of observational statistics is to carefully match, or mathematically account for, important differences in study participants that could not be controlled.

HumanCapitalR_x assumes there are two dominant factors that control observations of a business metric:

1. The nature of the individual producing the observation. Individuals are differently gifted in terms of intelligence, motivation, diligence, and social skills, and these aspects will strongly affect their observations.
2. The time at which the observation was recorded. Many business metrics are economically linked (for example, it is easier to sell almost anything when the stock market is high and unemployment is low). Other metrics are affected by company wide changes (rolling out a new model or modernizing an assembly line) or changes that affect an entire industry (e.g., a drought in the Midwest, or changes in teenage spending habits).

The first, personal performance, has been difficult to categorize prior to HumanCapitalR_x. HumanCapitalR_x uses each individual client's business metrics and rates each participant on their prior performance for that metric, before the beginning of the initiative. This provides an almost airtight statistical control to adjust for any biases that may exist in the selection of participants for the initiative. *Indeed, in nearly every study* HumanCapitalR_x has ever conducted, prior performance was a highly significant factor in predicting future performance, even in studies where the initiative did not show a significant impact. HumanCapitalR_x divides participants into five levels or *quintiles* using their performance prior to the training, giving executives clear, precise groups to use for decision making.

11 An excellent reference on this topic is Rosenbaum, Paul R. (1995) *Observational Studies*. Springer series in statistics. Springer-Verlag, New York.

12 Mantel, N. and Haenszel, W. (1959). Statistical aspects of retrospective studies of disease. *Journal of the National Cancer Institute*, 22, 719-748

13 Hoffer, T. Greeley, A., and Coleman, J. (1985) Achievement growth in public and Catholic Schools. *Sociology of Education*, 58, 74-97.

14 LaLonde, R. (1986). Evaluating the econometric evaluations of training programs with experimental data. *American Economic Review*, 76, 604-620.

15 Doll, R. and Hill, A. (1966). Mortality of British doctors in relation to smoking: Observations on coronary thrombosis. In: *Epidemiological Approaches to the Study of Cancer and Other Chronic Diseases*, ed., W. Haenszel). U.S. National Cancer Institute Monograph 19. Washington, DC: US Department of Health, Education and Welfare, p. 205-268.

Since change over time in an individual's performance is the essence of measuring the ROI for training, time is automatically included in HumanCapitalR_x models. This is important because many factors that affect business metrics vary over time. By including time in the HumanCapitalR_x calculation, it puts the metric into context with other trends or events that happened over the same time, such as 9/11, weather conditions, or election year jitters. These trends affect both trained and untrained participants and these trends are now accounted for with HumanCapitalR_x.

By using the client's data for the business initiative, prior performance, and time, HumanCapitalR_x can construct a solid and stable statistical model to measure ROI for the initiative. In addition, information about the participants, such as their job title, geographic region, or tenure, can be entered into the model. This allows for an even closer statistical modeling and provides an additional benefit of a predictive tool for these variables we refer to as "optimization" (e.g., how the initiative can be optimized in the future).

For example, in one HumanCapitalR_x study, sales representatives were classified into different selling styles based on their regional opportunities and their managers' observations. The styles showed clear differences in their reactions to one of the trainings, with one style receiving a very strong benefit from one of the trainings, while another style received almost no benefit from the same training.

HumanCapitalR_x produces a report on the statistical significance and effect of each factor in the model. This includes:

- The effect of prior performance on current performance
- A quintile-based analysis of whether different levels of performers reacted differently to the initiative
- An analysis of whether the overall value of the metric changed over time.
- Any additional "participant descriptors" added to the model are also reported, both in terms of their main effect and their interaction with the initiative.
- If two initiatives are used in the statistical model, and if there is an interaction indicating a "synergy" or "diminishing returns" effect, this is also reported.
- Finally, to alert the reader to any possible hidden biases, an analysis is presented that searches for patterns in who received the initiative.

The Mathematics Behind HumanCapitalR_x

In the development phase of HumanCapitalR_x, a wide variety of statistical techniques were considered for the model. General Linear Models (GLMs)¹⁶ are a statistical model

16 Mantel, N. and Haenszel, W. (1959). Statistical aspects of retrospective studies of disease. *Journal of the National Cancer Institute.*, 22, 719-748.

which ties the effects of many inputs (the data provided by the client) to one output, such as sales increases, help desk tickets, return rates, customer satisfaction, etc. General Linear Models (GLMs) were selected as the best primary technique for a number of reasons:

- GLMs produce both an estimate of statistical likelihood that a variable produces an effect, and the magnitude of that effect. In other words, GLMs tell us how likely it is that a factor affected your business metrics and, if so, how significant of a factor it is. (Typically, HumanCapitalR_x reports effects only when we have a 95% certainty of its impact.)
- GLMs are the most widely accepted model in use in behavioral and cognitive psychology. They have scientific credibility in areas similar to training.
- Effects produced by GLMs are provably optimal and non-biased¹⁷. The results HumanCapitalR_x derives cannot be mathematically improved upon. Being non-biased, the results don't overstate or understate the ROI of the initiative.
- GLMs integrate variables that fall into categories (gender, trained/untrained, job title, region of the country, etc), and those that are continuous numbers in the same model (salary, years of experience, number of customers, etc.) and solve these equations simultaneously.
- GLMs are more powerful than many of the commonly used statistical techniques, such as regression, t-tests, and other techniques.
- Most statistical methods work with traditional "bell-shaped curve" data used throughout business and society which measure normal distributions and averages. When there is data that does not fit into the traditional "bell-shaped curve," such as hardware device failure times, statistical sampling of assembly lines, and traffic patterns on computer networks, GLMs still produces valid conclusions.

HumanCapitalR_x uses an analysis technique that looks for synergy between a business initiative and several variables. It examines interactions between a business initiative and prior performance, considers any variables that are added to the model, and, if the analysis uses two different initiatives, between the two initiatives themselves. The end result is that it allows a deeper understanding of what group generates the highest return on investment. Companies can make better decisions on how to tune their investment strategy, where new investments should be explored, and how effectively their investments can be combined.

McCullagh, P. and Nelder, J.A. (1989) *Generalized Linear Models (2nd Ed.)* London: Chapman & Hall

¹⁷ Bock, R. Darrell. (1985) *Multivariate Statistical Methods in Behavioral Research*. Scientific Software, Inc. Champaign, Illinois

The Importance of Using General Linear Models in HumanCapitalR_x

The importance of using General Linear Models as the basis for HumanCapitalR_x lies in the fact that they allow us to measure multiple factors in a 'soft' business initiative and determine how likely it is that any factor significantly affected a business metric and, if so, how significant the effect is.

Even though GLMs produce a high level statistical validity for ROI studies, the average company does not use them to do their own ROI studies because they are difficult for them to use. They require special expertise to set up the data, conduct the analysis, interpret the results, and present them in cogent financial and business terms. The average company is unlikely to have this expertise. There are only a few packages that implement GLMs, and these are expensive and require specialists to work with.

Advantages of A HumanCapitalR_x ® ROI Analysis

Using HumanCapitalR_x provides a number of clear advantages for measuring ROI on 'soft' business initiatives.

1. HumanCapitalR_x provides a step-by-step process for collecting and importing the data of your choice for the study.
2. HumanCapitalR_x uses a solid, unbiased, and quantitative methodology to analyze that data.
3. HumanCapitalR_x provides a final report that integrates financial information with 95% statistical certainty, and illustrates these with simple business graphics. Financial information such as the Cost-To-Benefit ratio (CB), payback period, and internal rate of return (IRR) are provided. The accessibility of this tool produces an ROI solution that is both easier to use and better grounded than most.
4. HumanCapitalR_x provides more than a simple ROI. With the added benefit of a predictive tool we refer to as '*Optimization*', HumanCapitalR_x takes ROI measurement beyond every current model. In the world of training, HumanCapitalR_x adds a "Level 6" to the 5 levels enumerated in the Kilpatrick/Phillips scale with '*Optimization*'. With other soft initiatives, HumanCapitalR_x can pinpoint what group benefited most from the initiative so that you can deploy future initiatives for maximum ROI.

5. HumanCapitalR_x provides this ROI quickly and inexpensively. In the area of training, the distribution, collection, and tabulation of questionnaires are expensive. Phillips¹⁸ has estimated cost of evaluating training at 4% to 7% of cost of the training itself. HumanCapitalR_x provides a substantial cost savings in both effort and expense.

Companies that have been data rich but knowledge poor will now have meaningful statistical information to measure and position ROI on their future soft business initiatives.

Summary

HumanCapitalR_x provides a sound, easy way to estimate the impact of ‘soft’ business initiatives for large organizations. It takes ROI measurement a step beyond all current techniques by using a software engine that imports corporate data and forms the data into General Linear Models (GLMs), a best-of-breed statistical approach validated by extensive research in observational statistics. The results are not only clear and understandable, but provide automatic calculations of important financial information, i.e. the ROI. HumanCapitalR_x takes this approach even further by identifying segments of the population who benefited the most from the initiative. This solution gives our clients both a bottom line validation of the initiative, and a look forward with the predictive tool, “Optimization.”

“Optimization” can produce a number of different, and important findings. For example, training might turn out to be more effective for people selling monthly services than for those selling installed devices. Mentoring might best be done in conjunction with training. Telecommuting might be more cost effective with one group of employees than another. ‘Optimization’ has been used on psychometric assessment, selling styles, seniority, region, education level, tenure, and job title.

The Appendix which follows contains three case studies that illustrate some of the key concepts outlined in this white paper.

18 Phillips, Jack J. (1997) Return on Investment in Training and Performance Improvement Programs. Gulf Publishing Company, Houston, Texas

Appendix

Case Study #1

A large company with approximately 2500 sales representatives was interested in an ROI analysis of their training programs. This company measured sales on a yearly cycle, and was interested in measuring the ROI of several different sales training programs. The company collected a wide variety of metrics, including gross commission, total sales, and a variety of other metrics related to the sales of specific products. Total sales was expressed in dollars and it was available for all sales representatives. Since improvement in this metric was agreed to be an obvious target of the training, it was used as the primary metric of study.

A HumanCapitalR_x analysis was conducted for three different training programs:

RESULTS: One training program produced an ROI of \$12.49 for every \$1 invested; another produced an ROI of \$14.62 for every \$1 invested. The remaining program did not produce statistically significant results.¹⁹

OPTIMIZATION: In the programs that produced statistical significance, several very interesting results were found that allowed the company to make specific changes to optimize their training. First, the low performers showed a much more dramatic improvement in performance following training. However, high performing sales representatives were selected for training with a much higher frequency than were low performers. This allowed the company to make two important policy decisions:

1. To focus recruitment for both training programs on participants in the lower performing segments. These segments were identified by prior performance, selling styles, and manager rating, giving the company a choice of different decision-making tools in optimization.
2. To develop a separate 'expert-level' training program designed to boost performance of their top people.

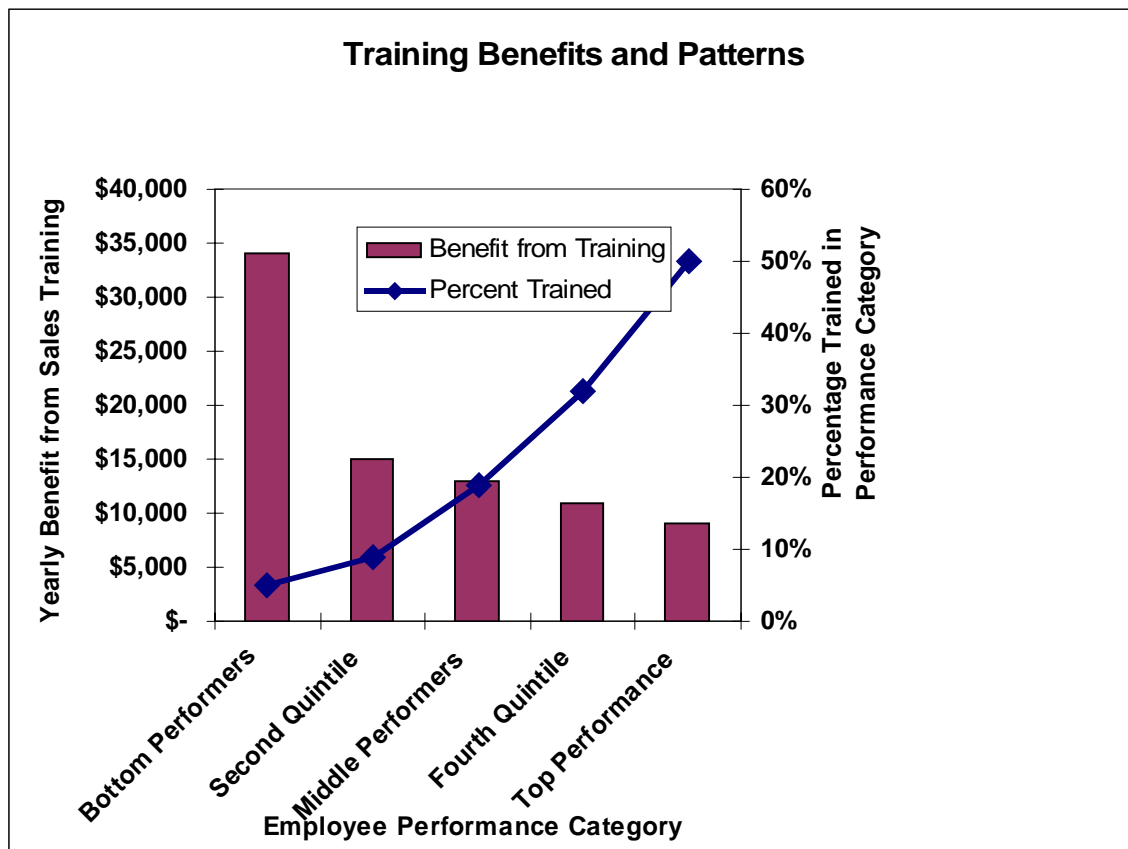
To illustrate the information HumanCapitalR_x provides for optimization, a detailed breakdown of the prior performance optimization follows.

¹⁹ The training program that did not show a statistically significant ROI was a very small mentoring program with extensive variation in the number of days mentors spent with their trainees. Since there was a lack of statistical significance because of the large variation in the data, the value of this training program should be considered inconclusive, rather than negative.

Predictive Optimization: HumanCapitalR_x identified that those who performed the best after the training were the historically low-end performers, who comprised 1% of the training class. The historical top performers, who represented 20% of the class, got far less from the training. These results indicate this training should not be given to the traditional top performers as it's not benefiting them and is taking them out of the field.

This graph shows that the HumanCapitalR_x software tool divided participants into five categories based on their performance prior to the training. Based on prior performance, the bottom 20% had the lowest sales, the top 20% had the highest, and so on. The height of the bars, measured in dollars on the left axis, shows the differences between trained and untrained participants in each of the categories. Note that the bottom 20% of performers shows the largest percentage increase of all participants. This is particularly interesting because the company had originally focused on training their top performers. The blue line across the chart shows the percentage trained (measured on the right axis) for the different groups.

The HumanCapitalR_x ROI results indicate the best return on investment would be achieved by focusing on the low performers. An alternative approach might be to modify the content of the course to include more advanced materials, or splitting off different courses for high and low performers.



Case Study #2

A large computer company had a mentoring program with over a hundred pairs of mentor/mentorees participating, and data on approximately five thousand other employees. These participants had a wide variety of job descriptions, making the choice of a metric difficult. The client decided to use human resource metrics in a HumanCapitalR_x analysis, such as promotions and performance-based merit raises, to analyze participant results.

RESULTS: This study showed a strong positive ROI not only for those being mentored, but interestingly, for the mentors themselves. Using calculations based on the assumption that the remuneration paid to an employee at least equaled their value to the company, the cost of the mentoring program was more than returned.

OPTIMIZATION: Within the training programs that showed positive ROI, HumanCapitalR_x used statistical techniques to determine which participants benefited the most from training. The participants were identified by prior performance, organizational group, and general job description (“engineering” vs. “administrative”). These results show not only where the current ROI comes from, but suggest demographic groups within the company that should be singled out as priority groups for training. Across the metrics that showed statistical significance, low performers profited more from being mentored than did high performers. Administrative employees showed a stronger benefit from the mentoring process than did engineering staff.

These findings allow the company to choose the participants for the training more effectively in the future.

Case Study #3

A large financial services company switched to an e-Learning provider to improve the technical savvy of their help-desk engineers. The HumanCapitalR_x analysis used data concerning the number, solution rate, and urgency of trouble tickets that had been collected over a twenty five-month period for over two hundred participants. The HumanCapitalR_x analysis also used information on participants, such as years of tenure, organizational unit, and number and type of certifications was also analyzed.

RESULTS: An ROI of \$9.52 for every \$1 invested over the study period was established. Interestingly, the benefits were not exactly as predicted before the study was performed. It was anticipated that the solution speed for trained engineers would improve. When the analysis was run, no speed improvements were found. Instead, the improvements lay entirely in number of tickets resolved. An increase in the urgency of tickets handled by trained engineers was also detected.

OPTIMIZATION: The optimization analysis revealed that engineers with certifications received the most benefit from the training.