Ready or Not? Assessing Change Readiness for Implementation of the Geospatial Technology Competency Model[©]

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A shortage of a qualified and skilled workforce exists to meet the demands of the geospatial industry (NASA, 2002). Solving today's workforce issues requires new and innovative methods and techniques for this high growth, high technology industry. One tool to support workforce development is a competency model which can be used to build a workforce. Implementation of a competency model is considered a major change initiative in organizations. Implementing a change such as this without assessing the readiness of the organization can result in decreases in profitability. This study develops a framework for the development of a change readiness scorecard for the implementation of the Geospatial Technology Competency Model©.

Keywords: Change Readiness, Competency Models, Geospatial

High growth industries are important to the future of the United States because of the competitive advantage they bring to the economy (ETA, 2003). The Department of Labor's (DOL) High Growth Job Training Initiative (HGJTI) is designed to help the United States continue as a leader in technological advances and economic advantages by developing skilled workers in the HGJTI areas. Based upon DOL's high-growth, high technology industries' projections, specialized skills training curricula need to be developed or upgraded to ensure workers have the right skills for the right jobs at the right time to meet United States economic development needs. Specific high-growth, high technology industries are targeted for the initial DOL HGJTI project focus (ETA, 2003).

One significant challenge in an emerging high-growth, high technology industry in the United States is the development of a well-trained geospatial technology workforce, as defined by the United States Department of Labor's Business Relations Group (ETA, 2003). Gaudet, Annulis, & Carr (2001) research yielded this definition for geospatial technology:

Geospatial technology is defined as an information technology field of practice that acquires, manages, interprets, integrates displays, analyzes, or otherwise uses data focusing on the geographic, temporal, and spatial context. It also includes development and life-cycle management of information technology tools to support the above (p. 7).

Geospatial technology includes remote sensing, geographic information systems (GIS), and global positioning systems (GPS). Remote sensing acquires information about an object without being in direct physical contact with the object. Satellite and aerial photography are examples (Korte, 2001). GIS is the software utilizing aerial and satellite imagery to create easy-to-read maps. GPS is a system of satellites enabling users to pinpoint locations on the earth's surface (Kennedy, 2001).

Problem Statement

A shortage of a qualified and skilled workforce exists to meet the demands of this high growth, high technology industry (NASA, 2002). A specific solution in support of workforce development for this dynamic industry is the implementation of the Geospatial Technology Competency Model© (Gaudet et al, 2001). Successful companies such as Raytheon, General Dynamics and Halliburton Worldwide apply competency models as workforce development tools to drive business processes and create frameworks that allow employees to understand workplace expectations in a more comprehensive way (N. Paxton-Taylor, November 14, 2003; D. Schweppe, December 15, 2003; personal communication). A considerable amount of literature exists on competency model development (Dubois, 1993; Dubois & Rothwell, 2000; Ingalls, 1979; Lucia & Lepsinger, 1999; McLagan & Bedrick, 1983; McLagan & Suhadolnik, 1989), yet the literature suggests no single, uniform systematic methodology to implement the models. Therefore, a need exists to address this gap because the value of the model is in its implementation and the outcomes resulting from implementation.

Competency modeling is a research methodology designed to describe work and jobs in a broader, more comprehensive way (Zemke & Zemke, 2000). Competency-based performance models yield a common language

across positions within an industry. It is the best approach when creating a performance management system and it enables workforce development professionals to identify core capabilities required of any employee in any position across an entire organization or industry (Gilley & Maycunich, 2000). In addition to performance management benefits, results from competency models can be easily translated into training curricula. While training programs based on work-oriented task analysis can become dated as work undergoes dynamic change, training programs based on competency assessment are more flexible and perhaps have more durability (Bohlander, Scott, & Sherman, 2001).

The GTCM describes the kinds of geospatial workers *(roles)* required, the products and services they provide *(outputs),* and the required knowledge, skills and abilities *(competencies)* that the industry needs. The knowledge, skills and abilities that are identified, along with the level of expertise required for each competency, provides a framework for geospatial technology curricula – academic courses and programs, as well as training programs.   In addition to being used as a research framework for training providers and academic institutions to use for creating the most effective and efficient training and education opportunities for the geospatial industry, the GTCM is a useful human resource tool. The GTCM provides research-based competencies for organizations to use to make better recruitment and selection decisions and to help better manage their existing workforce by using the model as a competency-based performance management system.

Readiness to execute a change effort such as implementation of the GTCM must be an antecedent to effective implementation. Identification of organizational barriers and critical success factors impacting implementation are critical. The most common barriers and success factors in the change readiness literature center on communication and commitment (Armenakis, Harris. & Mossholder, 1993; Baldwin, 2001; Ball, 2000; Beer, Eisenstat, & Spector, 1990; Connor, & Patterson, 1982). Other factors, outside the scope of this study, may influence change readiness such as trust, environment, leadership, culture, motivation and decision processes. Subsequently, the purpose of this study was to determine factors that impact a change initiative and create a framework for a workforce readiness scorecard for implementation of the Geospatial Technology Competency Model©. Specific objectives were to:

1. Identify factors perceived by geospatial human resource managers that impact the ability of geospatial organizations to implement change.
2. Determine existing characteristics required for change perceived by human resource managers of geospatial organizations as measured by:
   a) Change readiness
   b) Affective commitment to change
   c) Perceived organizational support
3. Identify the channels and sources of communication utilized during change as perceived by human resource managers of geospatial organizations.
4. Develop a framework to assess change readiness for geospatial organizations.

The research question that guided this study was, "How do organizations assess if they are candidates for implementation of a competency model and also determine when and if they are ready to apply the model, in other words, implement this change?" Organizations simply having access to the GTCM does not necessarily translate into a better-trained workforce. Leaders must understand how a competency model fits within their organization and consider systemic factors impacting organizational readiness to both implement and integrate competency models as a workforce solution. Successful implementation requires managers to develop effective and efficient readiness processes and tools. One such tool is a research-based, industry-specific workforce readiness scorecard. This scorecard helps managers determine if an organization is a candidate for specific change activities and identifies pitfalls to avoid *before* implementing a change or new program in an organization.

Hundreds of consulting firms market scorecards as analysis tools for determining if a product is right for an organization. Many scorecards appear to be designed from a combination of unrelated survey questions that may or may not address the readiness of the organization to implement a change (deJager, 2001). However, given the absence of a systematic, research-based process for scorecard development, practitioners often create scorecards using their experience rather than research-based data (W. Lee, May 19, 2003; K. Krayer, May 19, 2003; J. Phillips, May 21, 2003; R. Stone, May 17, 2003; personal communication). This experience-based method of scorecard creation may produce successful results in some change implementation instances or industries but not others. In contrast, the readiness scorecard helps managers determine the organizational "fit" of a specific change activity. Scorecards which address such organization-specific change readiness needs are lacking and can greatly assist organizations in analyzing and addressing implementation issues associated with any organizational change effort.

Theoretical Framework

A company's ability to become and remain change-capable is key to sustaining marketplace success and strong corporate performance. Organizations committed to maintaining competitive advantage use tools both to diagnose organizational health and overall change readiness on a regular basis. Researchers suggest that numerous factors contribute to the speed and effectiveness with which organizations implement changes, with one predominant factor being the initial readiness of an organization and its employees to undertake change. Readiness is the predisposition or willingness to make a change (Webster's New World Dictionary, 1999). Change readiness is reflected in organizational members' beliefs, attitudes, and intentions regarding the extent to which changes are needed and the organization's capacity to successfully make those changes (Armenakis, Harris, & Mossholder, 1993). Readiness, similar to Lewin's (1951) concept of unfreezing, is reflected in organizational members' beliefs, attitudes, and intentions regarding the extent of change needed and the organization's capacity to successfully complete the process. Readiness is the 'cognitive precursor' to behaviors of either resistance to, or support for, a change effort (Armenakis, Harris, & Mossholder, 1993).

The theoretical foundations of change readiness include social exchange theory and social learning theory. Social exchange theory explains initiation, strengthening, and continued maintenance of interpersonal relationships and provides a possible conceptual basis for understanding relationships between individuals and their work organization (Thibault & Kelley, 1952). Social learning theory emphasizes the importance of observing and modeling behaviors, attitudes, and emotional reactions of others (Bandura, 1997).

The norm of reciprocity, central to social exchange theory, obligates people to respond positively to favorable treatment received from others. In other words, "people should help those who help them" (Gouldner, 1960, p.161). Reciprocity implies that if the desire for stability in a social system exists, some degree of mutuality of gratification must also exist. The general idea associated with reciprocity, is to "give back benefits to those who give benefits" (p. 162). In order to build loyal relationships with employees, organizations realize the importance of understanding how employees view their policies, change initiatives, and motives. This understanding fosters a reciprocal exchange philosophy (Eisenberger et al, 1986).

Social exchange theory, known as a relationship maintenance theory, explains how people arrive at their decisions in relationships. The theory posits a matrix system of measuring outcomes, taking into account the actions of others, rewards and costs, minimizing and maximizing costs, comparing results, dependence and control, prediction, and transformations. Social exchange suggests that as employees perceive greater support from the organization, their willingness to engage in innovative initiatives grows. In addition, helping to increase organizational productivity becomes a priority of employees. The organization's efforts to help "ready" or develop employee skills through training and development programs, may increase employees' positive perceptions of the organization (Thibault & Kelley, 1952). Like social exchange theory, social learning theory (Bandura, 1977) explains human behavior in terms of continuous reciprocal interaction between cognitive, behavioral, and environmental influences. Based on three principles, Bandura's (1977) social learning theory postulates a person's motives to act in a certain way. First, organizing and rehearsing the modeled behavior symbolically and then enacting it overtly to achieve the highest level of observational learning. Coding modeled behavior into words, labels or images results in better retention than simply observing others. Second, individuals are more likely to adopt a modeled behavior if it results in outcomes they value. Finally, individuals are more likely to adopt a modeled behavior if the behavior has functional value and the model is similar to the observer and has admired status.

Social exchange theory and social learning theory underpin change readiness. People undergo cognitive processes to determine if they will accept changes within organizations. Employees will observe others, measure outcomes, compare results and make predictions related to change. Social exchanges help people determine if they are ready to accept change and respond favorably to the change.

A classic study by Coch and French (1948) offers early work in the change readiness literature. An experimental design study describes ways to reduce resistance to change efforts by allowing organizational members to participate in the change activity. Upper management effectively communicated the message regarding the need to change to employees in one group. The result was a change in behavior resulting in positive actions. The researchers found that the productivity of this experimental group exceeded that of the comparison group. This seminal study suggests that a vital link between management and employees during change efforts is communication.

The foundational theories and seminal study above provide grounding for the present study. The ideas point to the need for assessment of current realities existing within organizations considering change implementation. The risk to organizations implementing a workplace change such as a competency model without conducting a proper analysis of employees' change readiness is a loss of business and decrease in profitability (LeBleau &Sobkowiak,

1995). Early diagnosis of change readiness in an organization ensures that valuable resources are allocated appropriately during times of change.

Research Methodology and Design

A purposeful sifting process, modified from Collins' (2001) "Good to Great" screening process, was used to identify twenty-seven exemplars in the geospatial industry. In Collins' study (2001), he attempts to determine universally distinguishing characteristics that cause a company to move from good to great. His study started with a large number of companies meeting a specific criterion, with the number of companies narrowed four times by applying greater stringency of selection criterion. Collins' (2001) methodology to determine exemplars is appropriate as a viable methodology to identify geospatial technology companies demonstrating best practices in the industry. The subjects in this research included human resources managers from the geospatial technology industry since they are the people most likely to be held accountable for change endeavors in their organizations.

Using a researcher-administered questionnaire, yielding a 78 percent response rate, human resources managers were interviewed by telephone and asked to describe factors that impact change initiatives. Optimal participation was ensured by the use of these specific actions: (a) providing advance communication; (b) communicating the purpose; (c) explaining who will see the data; (d) keeping the questionnaire as simple as possible; (e) simplifying the response process; (f) letting the participants know they are part of the sample; (g) considering incentives; (h) using follow-up reminders; and (i) sending a copy of the results to the participants.

The six-section survey instrument identified factors perceived by geospatial human resource managers to impact the ability of geospatial organizations to implement change. The sections included perceived organizational support, affective commitment, change readiness, communication channels and sources, open-ended questions regarding change implementation, and demographic data. The survey instrument determined employee perceptions required for change perceived by human resource managers of geospatial organizations as measured by change readiness, affective commitment to change, and perceived organizational support. In addition, the survey instrument provided identification of the channels and sources of communication used during change.

The survey instrument began with a vignette discussing the implementation of the GTCM in a geospatial organization. A five point Likert scale from very ready to not ready at all was included for each item. The geospatial HR managers circled the levels of agreement with each item, as they perceived the employees in their organizations would respond. The items were tallied to determine scores. The total score indicates the degree of readiness of the organization to implement the GTCM.

Participants answered a combination of validated survey instrument questions. In addition, researcher-designed questions captured rich qualitative data. A researcher-developed script for the introduction of the telephone interview was utilized.

Ten factors derived from Price Waterhouse Change Integration Team® (1995) change readiness assessment tools were incorporated into the survey. These factors influence the success of major change programs at Price Waterhouse and are as follows:

1. The change program is clearly defined.
2. Accountability measures are in place for change processes.
3. There is adequate sponsorship for change.
4. There are adequate resources for change.
5. Changes have apparent rationale for the change actions.
6. Benefits of the change initiative are well defined.
7. Adequate resources are available for change processes.
8. The company focuses on business results during the change effort.
9. Improvement opportunities are identified in the organization.
10. The company looks for benchmark targets outside of the organization and beyond the geospatial industry

Respondents rank ordered items from the Price Waterhouse Change Integration Team® (CIT) change readiness items to determine the most important change readiness factors to employees of geospatial organizations during times of change as perceived by HR managers. Specifically, participants were asked to rank order on a scale from "1" (most important to employees) to "10" (least important to employees) the items perceived as most important to least important to employees during change initiatives. Second, participants indicated the level of agreement with each item by using a 5-point Likert type scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). Finally, participants were asked to circle "yes" or "no" if the item should be included when assessing an organization's change readiness. In other words, is this item important to employees during change? Also included was identification of the channels and sources of communication utilized during change. The final

data helped determine factors that affect change readiness and ultimately this data aided in the development of a framework for a workforce readiness scorecard for change implementation.

Data Analysis

Data was analyzed using descriptive statistics including reliability analysis, frequencies, Chronbach's Alpha, and Friedman's tests. Specifically, a reliability analysis on perceived organizational support, change readiness, and affective commitment sections of the survey produced a Chronbach's Alpha. This measure showed the extent to which items composing an index measure the same construct. Carmine and Zeller (1979) argue that alphas of .70 or higher indicate high reliability for widely used scales are acceptable. The research calculated frequencies to better understand employee perceptions, commitment, and communication patterns in times of change. A Friedman's test was used to determine if significant differences existed between the rank-ordered items. Friedman's test is a non-parametric analysis and is especially useful with data that do not meet parametric analysis of variance assumptions (Zar, 1984). Presence of a significant, positive relationship indicates variables will vary in a unified direction (Jaeger, 1990). A Friedman's test revealed the items on the scale of change readiness had a significant difference ($p < .000$) and a chi-square of 107.784.

Results

The cumulative number of respondents ranking change readiness items in the top three items on the change readiness scale is shown in Table 1. Seventeen respondents ranked "clearly defined" in the top three items in the change readiness scale indicating a strong agreement that this item is important to geospatial employees, as perceived by HR managers. The item coded as "benchmark targets outside" was ranked in the bottom three by almost all respondents (N=20), indicating that HR managers did not think that geospatial employees believe looking for benchmarks outside of the company is important during times of change.

Respondents indicated level of agreement for each of the change readiness items that would be important to geospatial employees during times of change, as perceived by their HR managers. A reliability analysis was conducted and found the change readiness scale to have an alpha of .87, indicating acceptability of the scale. The five-point Likert scale ranged from "1" (strongly disagree) to "5" (strongly agree). The item coded "clearly defined" received the highest mean, 4.61, on the Likert scale, indicating that HR managers believe geospatial employees would think that clearly defining change initiatives would be most important to them during times of change. Almost all (N=20) people either "agreed" or "strongly agreed" to the item coded as "clearly defined." All questions revealed some respondent answers as "neutral." Few "disagree" responses were reported for items in the change readiness scale. Of twenty-one respondents, only five respondents "disagreed" or "strongly agreed" and four "disagreed" to the item coded as "benchmark targets outside."

Table 1. *Change Readiness Ranking Top/Bottom*

Employee perception	Number (n=21)	Top Three	Number (n=21)	Bottom Three
Clearly defined	17	81	0	0
Benefits well defined	15	71.4	0	0
Apparent rationale	15	71.4	2	9.5
Adequate sponsorship	6	28.6	6	28.6
Adequate resources	5	24.2	1	4.8
Accountability measures in place	3	14.3	9	42.8
Improvement opportunities	2	9.6	9	42.8
Adequate resources available	0	0	2	9.6
Focus on business results	0	0	14	66.7
Benchmark targets outside	0	0	20	95.3

Respondents answered in a resounding "yes" (N=21) to include the item coded "benefits well defined" when assessing change readiness of the organization. A close second was the item coded as "clearly defined" (N=20).

More than half of respondents believed all ten items should be included when assessing an organization's change readiness.

Table 2. *Items for Inclusion in Assessment*

Employee perception	Yes (n=21)	%	No (n=21)	%
Benefits well defined	21	100	0	0
Clearly defined	20	95.2	1	4.8
Accountability measures in place	19	90.5	2	9.5
Adequate resources	19	90.5	2	9.5
Adequate sponsorship	18	85.7	3	14.3
Apparent rationale	18	85.7	3	14.3
Improvement opportunities	17	81	4	19
Adequate resources available	16	76.2	5	23.8
Focus on business results	13	61.9	8	38.1
Benchmark targets outside	11	52.4	10	47.6

Table 3 shows the cumulative number of geospatial HR managers who believe each of the six items should be included when assessing an organization's change readiness. Almost all of the respondents (N=20) said "yes" the item coded "better because of the change" should be included when assessing change readiness. Almost half of respondents (N=12) did not think "good strategy" should be included when assessing an organization's change readiness.

Table 3. *Items for Inclusion in Assessment*

Employee perception	Yes (n=21)	%	No (n=21)	%
Better because of the change	20	95.2	1	4.8
Necessary	18	85.7	3	14.3
Serves important purpose	17	81	4	19
Belief in the value	15	71.4	6	28.6
Good decision	15	71.4	6	28.6
Good strategy	12	57.1	9	42.9

Analysis of the data collected in the research project provided a framework with which to assess change readiness for the implementation of the Geospatial Technology Competency Model© in geospatial organizations. Perceived organizational support, change readiness, affective commitment, channels of communication, and sources of communication were used to construct the framework. Barriers and success factors identified by human resource exemplars in geospatial technology industry organizations were also included in the framework. The framework provided a tool for human resources managers in the geospatial industry to assess the organization's readiness to implement the GTCM. The 20-item framework yields a score ranging from 0-100 and "not ready at all" to "very ready" to implement the GTCM.

Findings

The major findings of the study were:
1. Geospatial HR managers determined the existing characteristics required for change as measured by change readiness. Participants reported that clearly defining the change initiative for geospatial employees is the most important item for assessing change readiness in their organizations. All items were ranked on a scale from "1" (most important to employees) to "9" (least important to employees). Items coded as "clearly defined" were ranked at the top (M=2.19), indicating that most geospatial HR managers believe clearly defining change initiatives for

employees is crucial to change implementation success. "Looking for benchmark targets" outside the organization and beyond the geospatial industry was the least important item for geospatial employees during change initiatives as perceived by their HR managers.

2.   When ranking affective commitment items required for change, HR managers of geospatial organizations determined two major characteristics. These items included employees beliefs that "things would be better because of the change" and that "change serves an important purpose." Participants reported that all items except for one, "this change is a good strategy for this organization," should be included when assessing a geospatial organization's change readiness.

a. HR managers of geospatial organizations did not perceive any difference in items measured by perceived organizational support constructs. All of the items were ranked high on a scale from "1" (most important to employees) to "9" (least important to employees). These items ranged from 3.81-5.76 indicating no difference exists in the way geospatial HR managers perceived items representing POS. Respondents agreed all items should be included when assessing an organization's change readiness. The item, "the company cares about employee opinions during change initiatives," was rated highest with almost all respondents (N=20), giving an affirmative answer indicating that this item should be included in a readiness assessment.

3. A framework was developed to assess change readiness for geospatial organizations. The researcher used the top three ranked items from each category mentioned above. Based on peer-review of other scorecards, a scorecard scale was created: very ready = 100-80; ready = 79-60; somewhat ready = 59-40; not ready = 39-20; not ready at all = 19-0.

Conclusion

Clearly defining a change initiative was perceived as a critical factor when assessing and facilitating geospatial employees' change readiness. This conclusion is based on the finding that geospatial HR managers ranked clearly defining the change initiative for geospatial employees as the most important item when assessing geospatial organization change readiness (M=2.19). Looking for benchmarks beyond the geospatial industry was not an important item when assessing organizational change readiness for geospatial organizations. Based on these findings the researcher would recommend that geospatial HR managers clearly define change initiatives when assessing readiness for a specific change. Geospatial HR managers should not invest time and valuable resources in looking for benchmarks beyond the geospatial industry.

Contribution to the HRD Field

This research was an initial attempt to determine factors impacting a change initiative for the geospatial industry. Results were used to create a workforce readiness scorecard for implementation of the Geospatial Technology Competency Model©. While several significant research articles exist in the literature on competency model development (Dalton, 1997; Dubois, 1993; Dubois & Rothwell, 2000; McLagan, 1983, McLagan, 1989; Sanchez, 2000), this study adds to both competency model and change readiness literature because there is little available information on implementing these models. Focus on creation of research-based competency models without producing empirical evidence of successful change implementation creates not only a gap in the literature, but also an open loop without processes for feedback to improve the model. More empirical research is needed to fully understand change readiness in the geospatial industry; further studies are needed to gain understanding about implementation of competency models in the geospatial industry, among others.

References

Armenakis, A., Harris, S. & Mossholder, K. (1993). Creating readiness for organizational change. *Human Relations, 46*(6), 681-702.

Baldwin, H. (2001). (August 1, 2001). The readiness gap. *CIO Insight Journal.* Retrieved June 2, 2003, from http://www.cioinsights.com available: http://www.cioinsight.com/article2/0.3959.44508.00.asp

Ball, L. (2000). IT education success strategies for change management. *Information Systems Management, 17*(4), 74-78.

Bandura, A. (1977). *Social Learning Theory.* New York: General Learning Press.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: Freeman.

Beer, M., Eisenstat, R. & Spector, B. (1990). Why change programs don't produce change. *Harvard Business Review,* pp.158-166.

Bohlander, G., Scott, S. & Sherman, A. (2001). "Training and Development," in *Managing Human Resources*. Cincinnati, OH: South-Western College Publishing, 12th Edition.

Carmine, E. & Zeller, R. (1979). *Reliability and validity assessment.* Beverly Hills: Sage Publications.

Coch, L., and French Jr., J. R. P. (1948) Overcoming resistance to change. *Human Relations, 1,* 512-532.

Collins, J. (2001). *Good to Great.* New York: HarperCollins Publishers.

Connor, D. & Patterson, R. (1982). Building commitment to organizational change. *Training and Development Journal, 36,* 18-30.

Dalton, M. (1997). Are competency models a waste? *Training & Development, 51,* 46-49.

deJager, P. (2001). Organizational change readiness. *Managing Change & Technology, 3,* 51-55.

Dubois, D. (1993). *Competency Based Performance Improvement: A Strategy for Organizational Change.* Amherst: Human Resources Development Press, Inc.

Dubois, D. & Rothwell, W. (2000). *The Competency Toolkit.* Amherst: Human Resources Development Press.

Eisenberger, R., Huntington, R., Hutchinson, S. & Sowa, D. (1986). Perceived organizational support. *Journal of Applied Psychology, 71,* 501-507.

Employment and Training Administration (ETA), Department of Labor (2003). Pamphlet: *The power of e^3.* [Brochure].

Gaudet, C., Annulis, H. & Carr, J. (2001). *Workforce Development Models for Geospatial Technology.* Hattiesburg, Mississippi: The University of Southern Mississippi, The GeoSpatial Workforce Development Center.

Gilley, J. & Maycunich, A. (2000.) "Performance Consulting," in *Organizational Learning, Performance and Change.* Cambridge, MS: Perseus Publishing.

Gouldner, G. (1960). The norm of reciprocity: A preliminary statement. *American Psychological Review, 25,* 161-178.

Ingalls, J. (1979). Throw away your job descriptions and write competency models. *Training, 16*(4), 32-34. Jaeger, R. (1990). *Statistics, a spectator sport.* (2nd ed.) Newbury Park: Sage Publications.

Jaeger, R. (1990). *Statistics, a spectator sport.* (2nd ed.) Newbury Park: Sage Publications.

Korte, G. (2001). *The GIS Book.* Albany: On Word Press.

Kennedy, H. (2001). *Dictionary of GIS Terminology.* Redlands: Environmental Services Research Institute.

LeBleau, R. & Sobkowiak, R. (1995). New workforce competency models. *Information Systems Management, 12*(3), 7-17.

Lewin, K. (1951). *Field theory in social science.* New York: Harper & Row.

Lucia, A. & Lepsinger, R. (1999). *The Art and Science of Competency Models.* San Francisco: Jossey, Bass/Pfeiffer.

McLagan, P. (1980). Competency models. *Training and Development Journal, 34*(12), 22-26.

McLagan, P. & Bedrick, D. (1983). Models for Excellence. *Training and Development Journal, 6,* 10-20.

McLagan, P. & Suhadolnik, D. (1989). *The Research Report.* Alexandria: American Society for Training and Development.

Monograph, NASA, 2002. NWDETI Business Implementation Plan; Imaging Tomorrow. John C. Stennis Space Center, Office of Education.

Price Waterhouse Change Integration Team. (1995). *Better change -Best practices for transforming your organization.* Burr Ridge: Irwin Professional Publishing.

Sanchez, J. (2000). The art and science of competency models. *Personnel Psychology, 53,* 509-511.

Thibault, J. & Kelley, H. (1952). *The Social Psychology of Groups.* New York: John Wiley & Sons.

Webster's College Dictionary. (1992). New York: Random House, Inc.

Zar, J. (1984). *Biostatistical Analysis.* (2nd ed.) Englewood Cliffs: Prentice-Hall, Inc.

Zemke, R. & Zemke, S. (2000). "Putting Competencies to Work," in *Training and Development Yearbook.* Paramus, NJ: Prentice-Hall.