THE ROLE OF EDUCATION IN THE SUCCESSFUL TRANSITION FROM TECHNOLOGIST TO GENERAL MANAGER

DISSERTATION

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by

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ABSTRACT

This qualitative research study addresses the following question: What role does education, in its various forms, play in the successful transition of an individual from technologist to general manager?

I argue that:

- The transition from technologist to manager is difficult and worthy of special attention.
- Education has traditionally played a significant role in technical and business career development.
- The role of education in this particular transition has not been adequately studied, with studies only at discrete points rather than along the total continuum from formal to experiential education.
- A better understanding of the role of education will lead to better decision making in corporate management development and individual career planning.

For this research, I used the word "education" to refer to the four-part continuum of education: formal, non-formal, informal, and incidental/experiential. Formal and non-formal education is an intentional and systematic enterprise while

informal and experiential education results in learning but learning is not the basic purpose.

This research revealed (1) the pattern of learning interventions along the educational continuum is different for those that made a successful transition versus those that did not. The learning for those that successfully made the transition was weighted toward the experiential end of the continuum, (2) the key educational content for those who successfully made the transition is cross-functional, and (3) this cross-functional education takes place early in a career.

The following theory emerged:

> For the successful transition from technologist to general manager the optimal educational intervention is to build on one's foundational formal education through a series of experiential and informal interventions that facilitate development of both basic management skills and cross-functional skills. Career choices impact learning content. Attitudes shift and become more generalist in nature. Breadth of learning should be the focus early in one's career with depth and complexity continuing throughout this career.

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CHAPTER 1

INTRODUCTION

My research addresses the following question: What role does education, in its various forms, play in the successful transition of an individual from technologist to general manager? In this dissertation, chapter 2 establishes that this is a significant research question that has not been adequately addressed in previous studies. Chapter 3 outlines my research plan to address this question. Chapter 4 provides the results of the research. Chapter 5 discusses the implications of the research. And chapter 6 states conclusions and areas for further research.

In addressing the research question, I modeled the transition from technologist to general manager as a transfer function,

$Y = f(a,b,c)$

where, Y = the outcome of transition from a technologist to a general manager.

Successful transition $Y = 1$

Unsuccessful transition $Y = 0$

The operational definition of successful transition is developed in chapter 2. The population to which this research applies begin their careers in a technical position (in a basic science or engineering). Their career development path takes them into a general

management function that covers multiple organizational functions. I looked at the transition phase and not sustained managerial performance.

I have chosen to refer to individuals who successfully made the transition as the "general management" group and the other subjects as the "technical" group. This was done to avoid labels of "successful" and "unsuccessful." I did not want to categorize any of the research subjects as unsuccessful. Only that they did not successfully make the transition to general management (which in most cases was their direct choice).

As I considered possible independent variables, I chose to assess the role of education. There are obviously other variables: such as sexual gender, personality, opportunity, functional skill set, personal preferences, and family, that have been documented in other studies as impacting career development. But I chose to limit this research to three independent variables of education.

a = The types of educational interventions lie on a continuum. (see chapter 2)

formal, a = 1;

non-formal, a = 2;

informal, a = 3;

experiential, a = 4.

These types of educational interventions were evaluated through a study of the career development of the research subjects to determine their relative contribution in a successful transition from technologist to general management.

b = what was learned and applied toward the subject transition.

learning and application with positive impact toward transition, b = 1;

learning and application with negative or neutral impact toward transition, b = 0.

I chose to state "learning and application" since I did not want to evaluate education as an accumulation of facts but as knowledge that is put into practice and changes behavior. I made this distinction by evaluating when new skills became a part of a career. If knowledge of new concepts are learned from an educational intervention but are not incorporated into a career practice, this did not constitute application.

c = timing when the educational interventions took place to have the greatest impact on career transition.

early career, c = 1;

late career, c = 0.

I expected to find educational interventions to have the greatest impact if experienced in the first 5 to 10 years of a career. However, as I used qualitative research methods, I allowed the final distinction of early versus late for this independent variable to emerge and be grounded in the data (Glaser & Strauss, 1967). For example, if I found that a subject began to utilize motivational and people management skills as a supervisor during a second job assignment four years into a career, I recorded this skill learned and applied at four years. Other educational content and times would be recorded in the same manner. A composite evaluation of the data, as discussed later in chapters 4 & 5, yielded a more definite understanding of early and late.

CHAPTER 2

LITERATURE SURVEY

In this chapter, I (1) present evidence that the transition is difficult and worthy of study, (2) survey literature that discusses why this transition is difficult, (3) provide an operational definition of successful transition, (4) discuss the continuum of the relevant educational interventions, (5) survey the research that addresses the traditional role of education in career development, and (6) address the value of the proposed research question and how the results may be applied.

I argue that:

- The transition from technologist to manager is difficult and worthy of special attention.
- Education has traditionally played a significant role in technical and business career development.
- The role of education in this particular transition has not been adequately studied, with studies only at discrete points rather than along the total continuum from formal to experiential education.

- A better understanding of the role of education will lead to better decision making in corporate management development and individual career planning.

The transition from technologist to general manager is worthy of study.

Research is needed on the transition from technologist to manager for two reasons. First, business needs qualified managers with technical and business training. Second, many people try to make this transition, but they find it to be difficult and some fail. For example, Lewey & Davis found that technologists who have advanced to management positions without having the requisite business and management skills "often find themselves in highly stressful or unrewarding jobs; their careers are stalled at a level far below their potential." (p.66, 1987)

Studies have confirmed that a large proportion of engineers in the United States perform some form of management during their professional career (Kocaoglu, 1982). The Engineering Manpower Bulletin No. 25 (1973) identifies that 82% of all engineers in the United States are in some management activity with 10% being in general management. This movement to management takes place early in a career as 62% of engineers in the age group 25-30 years old are in management. Studies have also looked at the CEO's of the top 1000 companies (Salgado, 1990). Salgado was able to find educational data on 864 of these CEO's and she found that 35.7% of them have an engineering-science background. This group of CEO's was second to business degrees at 56.5%. Some members of these two groups had multiple degrees. Among multiple

degreed CEO's, the most common combination was engineering-science/business representing 8.6%

Some research data indicate that engineers may not respond to certain educational interventions as well as peers with a different background. Harrell and Alpert (1989) document engineers' response to MBA studies. Their longitudinal study of MBA graduates indicates that "specialized education" as exemplified by an MBA has less correlation with career progression for individuals with bachelor's degrees in engineering fields than it does for non-engineers. Their study does not address career progression, without MBA or other specialized training.

Some technical individuals have performed well and want recognition for their performance (often in the form of higher pay) without moving into broader management positions. This situation has led to the common practice for technology-oriented companies to develop dual career paths to recognize and retain valuable engineers and scientists. The presence and impacts of dual ladders have been documented in various publications (Bawdny, 1982; HR Focus, 1992; Pearson, 1993). One ladder is for those who desire to remain as technical contributors or supervisors/managers of only technical activities. The second ladder requires the development of broader business skills and general responsibilities that go beyond the technical role.

Some of the difficulties in making the transition to management are not unique to technologists. For example, Medcof (1985) argues that technologists moving into management must deal with problems seen by anyone in a career change: changed peer

relationships, adoption of a more generalist view, and personal evaluations of the importance of the career change.

Because technology is playing an increasing role in all businesses, managers must have a sound understanding of technology. These managers can be created by training business people in technology (Ramo, 1989) or by training engineers in business (Kocaoglu, 1980). In this research, I focused on the latter route. Businesses have a need for technically trained managers, especially in technological industries. They need to help people couple a strong knowledge of technology with business skills, and apply combined technical knowledge and business skills to help companies expand and use technology wisely.

Why is the transition difficult?

Researchers have also examined why the transition from technologist to manager is difficult. Generally, they cite reasons that revolve around the differences between technologists and managers in skills and personality. Medcof (1985) provides a useful structure for discussing these differences and I will use five of his categories to describe his findings as well as the findings of others.

1) Social Interaction. Medcof (1985) argues that technologists, by training and usually disposition, prefer to work with things rather than people. Management is concerned primarily with people. Other researchers have also identified a lack of training or development of interpersonal skills and relationships as a key problem for development of scientists and engineers (Stokes, 1994; Pearson, 1993; Rosenbaum, 1990; Krembs, 1983; McCall *et al*, 1988)

2) Dealing with Management Intangibles. Medcof (1985) states that the difficulty in management is not that technologists cannot deal with intangibles but dealing with the particular set of intangibles that are used in management. Management is more of an art than a science. Management often makes decisions intuitively and deals with people issues or strategic thinking where there are no "Laws of Physics."

Vaill and Mintzberg have made similar observations. Vaill (1989) encourages managers to learn from the performing arts by practicing and rehearsing management skills rather than just knowing a list of functions while leading companies through "permanent white water." Mintzberg (1973) observes that management tasks are opened-ended in nature. Engineering tasks have a more tangible closing with the completion of a particular design.

3) Decision Making. Medcof (1985) states that technologists find it difficult to make decisions based on incomplete, concrete data. Managers often make such decisions based on their intuition.

Karp (1990) makes a similar comparison about the different thought processes between technologists and human resource development (HRD) professionals. He shows that training methods are impacted as technologists tend to be more "left-brain" while HRD professionals are more "right-brain," resulting in clashes involving precision versus meaning, science versus scientism, cognitive versus experiential learning, and analysis versus awareness.

4) Management Technology. Medcof (1985) states that technologists often have a limited knowledge and understanding of modern management techniques.

5) Management Values and Attitudes. Medcof (1985) states that technologists need to switch from an attitude of pursuit of perfection to a managerial attitude of designing a package that satisfies needs well.

Medcof (1985) concluded that additional research was needed to determine how to help individuals make the successful transition from a technical role to a management role. He also stated that there should be particular research to obtain data from technologists who have made this transition rather than outsiders.

Thus, Medcof and others have identified traits of technologists that impede their transition to managers and have linked this difficulty to the nature of technologists. Bawdny (1982) found three basic problems that were similar to Medcof's. One is the nature of engineers and scientists in preferring to work with things instead of people. The second was the basic nature of engineering education that is built around laboratories and scientific laws rather than the intangibles of people issues. Finally, the nature of the organizational policies or actions may not prepare engineers for management. Engineers and scientists have some of their greatest business impacts through their technical accomplishments. This causes companies not to encourage development and knowledge in other business related areas.

The above research is useful because it indicates a knowledge base of business skills needed for the transition to management is identifiable and the skills are learnable through some form of education. While not specifically comparing the skills of

technologists and managers, Thamhain (1992) categorizes basic business skills as leadership and people skills, technical skills and administrative skills. He further argues that these skills are learnable. Vaill (1989) stated that managers need to be learning from the performing arts by practicing and rehearsing management skills rather that just knowing a list of functions. Perhaps the best evidence that education may be useful in this transition is that career changes often trigger educational interventions (Aslanian & Brickell, 1980). This proposition will be discussed later in this chapter.

Defining successful transition.

As I pursued this research, I focused on the successful transition process in career development from technologist to general manager. This framing of the research question recognizes three different decisions that I made to clarify the research.

First, there is potentially a differentiable role of education in success stories versus failures and I chose to look at the success side. Companies want to avoid inefficiencies and costs that go along with personnel problems and failures. Individuals do not like to participate in or admit to failures. Therefore, this research focused on first identifying the role of education in successful transitions.

Second, when looking at the dual career ladders I was primarily concerned with the general management path. In order to make sure that what was identified in this research was truly related to success in movement to general management, interviews were also conducted with people who remained in technical career positions or tried and failed to make the transition to general management. This secondary focus compared and

identified differences in the independent variables in order to make sure that the findings truly answer the research question.

Since companies have established dual career paths for technologists and general managers, they have also created different expectations, evaluations and development plans. I, therefore, anticipated that both the basic educational content and process would be different for the different dual career tracks.

And finally, before identifying research subjects, it was necessary to establish a definition for successful. First, the subjects were looked at only for their ability to accomplish the transition, not sustained managerial performance. Therefore, the subjects must have begun their career in an engineering or basic science technical position and moved to general management. According to Wheelwright and Clark (1992), general managers develop, operate and have responsibility across functional boundaries and manage a business as a system rather than optimize individual functions. Therefore, the evaluated subjects were limited to those who work in a position with responsibilities over multiple functions of an organization. These responsibilities included strategic, financial and organizational areas. To avoid individuals in temporary or acting capacities, I added the requirement that the subject must have worked at a general management level for at least three years. I could not find any study that defined how long was required for a clearly successful move to general manager. Therefore I set three years based on my own experience where individuals moved into a management position were allowed less than a year to effect the transition to the new position, another year to bear results that

met or exceeded goals and then a third year for upper management to make a personnel change if required.

This research question also does not deal with sustained management success. Other researchers have performed extensive documentation of both maintaining successful management and avoiding failures (McCall *et al*, 1988; Kofodimos, 1989; McCall and Lombardo, 1983).

I also avoided those individuals who are in lower level engineering and management positions since they have not proven that they can make the required transition.

This research question did not just deal with the transition but was further qualified by the role of education in that transition.

Educational interventions.

For this research, I used the word "education" to refer to the four-part continuum of education as described by Boggs (1993): formal, non-formal, informal, and incidental/experiential. Formal and non-formal education is an intentional and systematic enterprise while informal and experiential education results in learning but learning is not the basic purpose. The descriptions in Table 1 result primarily from personal communications with Dr. Boggs and literature surveyed.

Some of the key characteristics of formal, non-formal, informal, and experiential are discussed in the paragraphs below.

Formal education is characterized by highly structured setting with course content and presentation designed to maximize the learning process. Maintenance costs are high

	Formal	Non-formal	Informal	Experiential
Structure	High	Medium to Low	Minimum to No	No
Maintenance	High	Minimal	Almost None	None
Format	Lecture/class	Small Group	One-on-One	One
Control	Professor	Speaker	Relationship	Student
Student Control of Content	Limited to None	Limited to None	Increased	High
Time	Set by degree requirements	Days or Weeks	Short Encounters Over Long Time	Dependent on Task
Reward	Grades/Degree	Certificate	Dinner/ Promotion	None/ Job Completed

TABLE 1. Educational interventions on a continuum.

due to classrooms, laboratories and administrative needs. Presentation method is often lecture with a teacher or professor in charge and homework required. The studentattendance to classes may be self initiated by desire to attend a particular university and obtain a degree, but a series of courses will be a requirement of an institution with the professor establishing course content. The student generally plays a more passive role as the receiver of knowledge. Completion of a predetermined series of courses over an extended period of time will result in the awarding of a degree or diploma. This area of education is typically seen in university and traditional schooling settings.

Non-formal education is usually a less structured setting that is still characterized by course content and presentation established to maximize learning. However, every effort is made to minimize the maintenance costs. Therefore, non-formal training often uses various facilities that can be used for purposes other than education. Administration is kept to a minimum. The presentation method may still often be lecture with minimal or no homework. The student's attendance is usually voluntary with the course content still determined by the teacher. The student typically continues to be the passive receiver of knowledge. The educational activity is usually a few days or weeks in duration and ends with the presentation of a certificate of participation or attendance. This type of learning can be seen in seminars and training courses.

Informal education is a less structured form of learning where the primary intent is not education. Maintenance costs are practically non-existent since there is no administration and the classroom is any location where applicable work is performed.

Learning develops under the guidance of a supervisor or mentor. Knowledge is transferred as the result of the relationship that exists between two individuals. The student becomes a much more active participate in determining both learning content and process. Informal education usually involves some form of hands-on learning or learning by doing. Each interface between the supervisor and student is usually short in duration but the relationship may continue for an extended length of time until skills are mastered. The resultant rewards of this area of learning may be improved performance, dinners, other social gatherings or career promotions. This area of education typically includes apprenticeships, internships or mentoring.

Experiential education is the least structured form of education. Sometimes this area of education is also referred to as incidental or consequential. Maintenance costs are non-existent as learning can take place in any setting. The student may be unaware that education is taking place but the student is in total control of both the learning content, process, length, and depth. Experiential learning involves the highest amount of student initiative. Each educational experience will last only long enough to complete a given task or solve a specific problem. There may be no perceived resultant reward or only the satisfaction of knowing that a task is completed. The process of education and learning may not be specifically recognized since it takes place as a part of other activities that are not normally associated with learning.

These four interventions: formal, non-formal, informal and experiential education, are on a continuum. Learning may occur at any point along this continuum with some

learning activities between the points. For this study I used this continuum as the operating definition of education.

Traditional role of education in career development.

The practices of individuals and companies indicate that they believe that education impacts and aids in career development. Adults pursuing education are often motivated by career changes. Aslanian and Brickell (1980) conducted a significant survey of adults to determine their participation in educational activities. Of those who acknowledged being in an educational activity, 56% gave career changes as the trigger event that caused them to pursue further learning. These career changes included both changes that had taken place or were anticipated in the near future. Also, companies often establish programs to help individuals acquire skills as they progress to higher levels of management. (Halperin, 1990; Smith, 1992)

I will now review the traditional use of formal, non-formal, informal, and experiential education in business careers. My review includes education as it is implemented in business for all types of employees, not just for those that are already educated in technology. I concluded that while many organizations provide and people seek education as part of the transition from technologist to general manager, the contribution education makes toward that transition was unclear and needed additional study.

Formal. The graduate level business education programs within American universities have been acknowledged as among the best in the world (Avishai & Taylor, 1989; Ramo, 1989; Spencer, 1990). Nevertheless, there is a recognized need for

improvement and change to meet the future needs of managers. MBA schools have come under fire for their reliance on traditional course structure and content (Linder & Smith, 1992). Universities have responded by trying to improve programs, but Jacobson (1993) criticizes current changes in MBA schools as only being superficial in nature. As managerial requirements continue to evolve in response to globalization and empowerment philosophies, even more change will be needed in formal, business education (Ziolkowski, 1994).

The need for training business people in technology (Ramo, 1989) or engineers in business roles (Kocaoglu, 1980) has been recognized and resulted in engineering and business colleges often joining forces to offer degree studies in Engineering/Technology Management. As stated earlier, research shows that an MBA may not yield a comparable rate of successful management career development outcomes for engineers and scientists as it does for others. (Harrell & Alpert, 1989)

Significant effort goes into making these formal education programs more attractive and meaningful to industry and alumni of undergraduate programs (Hawks, 1994; Raper, 1994; Lavelle, 1994; Munsterman & Houshyar, 1994; Terry *et al*, 1994; Suchon *et al*, 1994). The referenced reports document efforts to make course offerings and educational methods more attractive to industry that encourages and pays for employees to attend or for individuals seeking additional education. But these studies did not address the question of what role education plays in the successful transition of individuals from the technical role to a general management role. Would these changes be more successful if framed in the context of the education continuum? My initial view

was that there can be a greater success rate, but no research had been done to show, for example, what part of the continuum has the greatest impact on career development. Companies should be encouraging education and development based on what has been proven to have worked, and avoid approaches that have lower success histories.

Non-Formal. Seminars and training courses are widely used in businesses. Estimates of business expenditures for seminars have ranged from $25-30 billion per year (Thompson, 1991) to $210 billion per year (Gilley & Eggland, 1989). From these publications I am unable to determine if the author's definitions or scopes are the same, but, in any case, these numbers are large and indicate that a lot of resources are going into non-formal education for both in-house and external courses.

The article title "Training: 'Just plain lousy' or 'too important to ignore'?" sums up the range of positions on the value of this form of education for business (Kelley, 1993). Training has been shown to be effective when it is focused on near term needs and very specific technical skills (Gordon, 1991; Wallace, 1993; Smock, 1993). Research has also shown that training is effective when linked to job related work experience (Ford *et al*, 1992; Ford *et al* 1993) and when there is a supporting organizational culture (Pickering & Matson, 1992; Crosby, 1992). These studies addressed discrete tasks that may be performed within a particular organization, but did not relate to the additional learning and skills development for the more intangible and "softer" skills of management.

Some employers feel that at least half of their training budget is wasted (Bickerstaffe, 1993) with management and soft-skills courses coming under particular

criticism (Gordon, 1991). Some employers even conclude that the external, public business seminar system is being heavily abused by presenters who do not deliver advertised course content, promised results that did not materialize, and are more entertainment than substance. Thus, some seminars become the source of disenchantment for managers who see "education" as the equivalent of company paid vacations without really expecting change (Thompson, 1991). Research of Cianni & Bussard (1994) shows that "the nature of firms' management development programs was not related to firm performance as compared to industry averages." (pg. 62). As I performed my research, I looked for evidence to support whether or not seminars are a valuable contribution to the successful transition from technologist to general manager and what that value may be.

Informal. Informal education includes on-the-job training such as apprenticeships, internships, and mentoring. The current literature predominantly limits apprenticeships to union settings, internships are limited to summer interns or medical situations, and mentoring covers a broader range that includes professional development. Therefore, of the three areas cited above, I chose to focus on research literature regarding mentors, the mentoring process and outcomes as directly applicable to this research question at this intervention on the education continuum.

For Levinson *et al* (1978), a mentor was an "older man" who had a special, intense long term relationship with the "male protégé." This seminal work on the mentoring process identified various roles of teacher, sponsor, counselor, developer of skills and intellect, guide and exemplar. Roche's (1979) historical study expanded the

definition of mentors to the notion of helper and sponsor without the need for a long term relationship. Shapiro, Haseltine and Rowe (1978) further expanded the definition by placing mentors on a continuum that ranges from peer pal (a friend at same career level), to guide, sponsor, patron and mentor. Kram and Isabella (1985) see the peer relationship as a developmental alternative to mentoring. The mentor definition has been appropriately changed to include women (Dreher & Ash, 1990; Cunningham & Eberle, 1993); and in some studies role models are added to the definition (Mainiero, 1986). From a different perspective, Dalton, Thompson and Price (1977) proposed four career development stages of apprentice, colleague, mentor, and then sponsor as a model of career development.

The mentoring research has been strongly criticized because the research literature does not use a consistent definition (Merriam, 1983). Within the literature there is a variety of definitions and pairings; i.e. formal mentoring versus informal mentoring (Chao, Walz, & Gardner, 1992), mentor control versus student control, strong relationship versus no relationship/role model. However, when mentoring is looked at along the education continuum that I chose, all of the definitions could be included by recognizing that they lie at different places on the continuum. Each of the above pairs involve informal education with the first area toward the formal side of the continuum and the second toward the experiential end.

Studies of the mentoring process have documented that the four phases of the process are initiation, cultivation, separation, and redefinition (Kram, 1983). Cunningham and Eberle (1993) documented that the mentor experience affects both the mentor and protégé.

Other literature has concentrated on the outcomes of mentoring rather than the process. Research shows that early career mentoring directly impacted early career promotions, career satisfaction (Whitely & Coetsier, 1993) and career decisions (Mainiero, 1986). Gender differences were not noted with respect to promotion rate, job satisfaction or frequency of mentoring in the Dreher and Ash (1990) study. However, Dreher and Ash (1990) were unable to explain a measurable difference in income of mentored men over mentored women. Whitely, Dougherty and Dreher (1991) noted that the greatest relationship between mentoring and promotion rate existed for those individuals from the higher socioeconomic backgrounds rather than those from the lower backgrounds. Chao, Walz and Gardner (1992) reported that the results of mentoring, when measured by higher levels of career progression, were greater for informal relationships that develop through natural relationships than for formal mentoring where mentors are assigned by company programs. They also reported that both formal and informal mentored careers had higher promotion levels than nonmentored careers. This literature indicated that I should expect education as a result of mentoring to have an impact on career transition. Unanswered questions include how strong is the impact of mentoring when evaluated with the balance of the continuum? Is there something unique

that can be determined for mentoring for the technologists that move to general management?

These studies show that the mentoring process can be very beneficial to career development. However, mentoring has problems and downsides (Braun, 1990; Sandler, 1993; Hurley, 1988). Harris (1994) believes that issues of diversity in the workplace and glass ceilings may not be solved with mentoring. Do people who successfully make the subject transition experience some of the downsides? What is the impact on the careers of those who don't move to general management?

Incidental or Experiential. Obviously, throughout their careers people spend significantly more time doing tasks rather than participating in formal education or non-formal seminars. Therefore experience, and learning that results from experience, was expected to play a strong role in career development. As stated earlier in the references about non-formal education, experience and organizational support can enhance the effectiveness of seminars in changing management behavior (Ford *et al*, 1992; Ford *et al*, 1993, Pickering & Matson, 1992; Crosby, 1992).

Sorohan (1993) cites two different studies that show that 90% of learning is informal or incidental. The content of the article did not define either informal or incidental or give a bibliography, but I concluded from what was stated that the studies did not differentiate between lower level workers and managers, making it impossible to identify what brought management success. My study evaluated only management levels and also compared similar levels in an organization to determine differences between the dual career ladders of technical people.

Lombardo (1985), McCall (1988), and McCall, Lombardo and Morrison (1988) have documented the impacts of key events on management development. Managers were interviewed and asked to identify the three "key events" in their career. From these interviews the researchers concluded the greatest experiential elements in management development fall into the three categories of: assignments, other people, and hardships. Regarding assignments as a factor, they state that "any assignment has developmental elements: The real issue is what are they, and what they might teach."(McCall, Lombardo & Morrison, 1988, pg 124)

Other Research The research report of Tharenou, Latimer, and Conroy (1994) presents a model for managerial advancement that, at first glance, might indicate that they have already addressed many of the elements that I stated above. Their model contains elements of education, training and development, career encouragement and work experience. However, their operational definitions for these variables actually differ from my model and definitions in significant ways. The education variable is simply a count of the number of years of formal education beyond high school. The training and development variable counted the number of seminar courses that were attended with no assessment of impact on career. The career encouragement variable measured extent of encouragement for promotion received from colleagues and more senior individuals both inside and outside an organization. Also, the work experience variable only counted the number of years of career tenure.

A critical look at the Tharenou, Latimer and Conroy (1994) study demonstrated why I felt a need for greater understanding in both depth and detail than their study

provided. Their study addressed the elements of education as discrete points and counted events based on quantity being the determining factor in career impact. I feel that education is much more complex than they demonstrated. Education takes place along a continuum. I sought to understand what is the relative contribution of the four interventions on the education continuum, what the most effective content is, and when the educational interventions should take place.

Value of this research study.

I have briefly discussed the difficult management transition for technologists and how the four learning interventions on the education continuum (formal, non-formal, informal, experiential) are used in business. As I performed this research I expected to find the following outcomes and results that result in transferability and application. I:

-assessed the relative contribution of formal, non-formal, informal and experiential education towards successful transition from technologist to general manager. A careful evaluation of career development and growth of each of the subjects supplied descriptive evidence so that relative importance could be established. Research evidence on relative importance should aid in decisions regarding how individuals might pursue education to maximize the benefit of career progression interventions and learning strategies for technologists.

-documented what was being learned during the educational process. The educational content was different for the technical and general management career paths. "Transition" indicates a change. And as

individuals change from a technical career to general management the content of what is learned relates to the success of the transition. This will allow individuals and organizations to tailor the content of educational interventions to meet career direction and avoid wasted activity on low or no impact educational content.

-documented when the most beneficial learning takes place for successful transition. As stated earlier, Whitely and Coetsier (1993) showed that early career mentoring had a positive impact on promotions and career satisfaction. I explored whether what was learned early in a career, regardless of where the learning takes place on the continuum, impacts promotions and career success. Timing, again, will impact decisions regarding educational interventions throughout an individual's career.

The research results will yield understanding of the how, what and when of educational interventions.

While I focused this research on the impact of education on individuals, knowledge of the how, what and when of the individual interventions will affect decision making by institutions.

CHAPTER 3

METHODOLOGY

In this chapter, I discuss (1) the qualitative research paradigm, (2) my research methodology and its consistency with standard qualitative research process, and (3) validity (trustworthiness) of results.

I will argue that:

- The qualitative research paradigm is appropriate because there is not a substantial base upon which to construct hypotheses, and because longitudinal data must be gathered.
- The results of this study will be valid (trustworthy) and transferable to others who are anticipating, experiencing or have completed this transition.

Qualitative Research Paradigm.

As I considered how to best answer my research question, I compared quantitative and qualitative research paradigms. Table 2 shows some of the key areas of difference between the two methods. These features are not necessarily found in every research study, but they do represent characteristics that would be found in most. Descriptions of these features have been well documented in literature (Bogdan and Biklen, 1992)

Qualitative	Quantitative
Interpretist	Positivist
Emerging Theory	Hypothesis testing
Study direction emerges with data	Study process detail planned
Detailed, thick narrative description	Data numerically reduced/ precise procedures
Inductive	Deductive
Holistic description of complex phenomenon	Break down of complex phenomenon into specific parts for analysis
Triangulation through multiple observances/sources	Validity with reliance on statistical indices
Purposive samples	Random samples
Researcher (human) is only instrument	Instrumentation
Study natural, uncontrolled phenomenon in native environment	Willing to establish laboratory test/evaluation scenarios to study phenomenon
Transferability, not generalization	Generalizability

TABLE 2. Comparison of qualitative and quantitative research paradigms.

(Lincoln and Guba, 1985)(Patton, 1987 and 1990) (Fraenkel and Wallen, 1993). As I looked at the research methods and what I desired to evaluate, I determined the qualitative research methods were most applicable to my research.

The study evaluates career changes that take place over an extended period of time. Qualitative methods allow for purposive sampling of individuals that have fulfilled the career outcome requirements of my model. By utilizing interviews and case studies, I looked retrospectively into careers of each subject and the data emerged for the independent variables. A detailed evaluation of multiple subjects and triangulation yielded data on relative importance of: (1) the types of educational intervention, (2) the content of the educational interventions, and (3) the timing of the intervention critical to successful transition. Qualitative research was the appropriate paradigm for this research study.

Research Design.

The qualitative research process has been well summarized by Lincoln and Guba (1985) in Figure 1. My research methodology follows this process and incorporated the key concepts; natural setting, human instrument, tacit knowledge, qualitative methods, iterative research, negotiated outcomes, and case report and tentative applications.

Natural Setting. The first demand of this type of inquiry is using the natural setting. Whatever the phenomenon being studied, meaning comes as much from the context and setting of the study as from responses of the research subject. The researcher is not just looking for answers to a series of interview questions, but is also

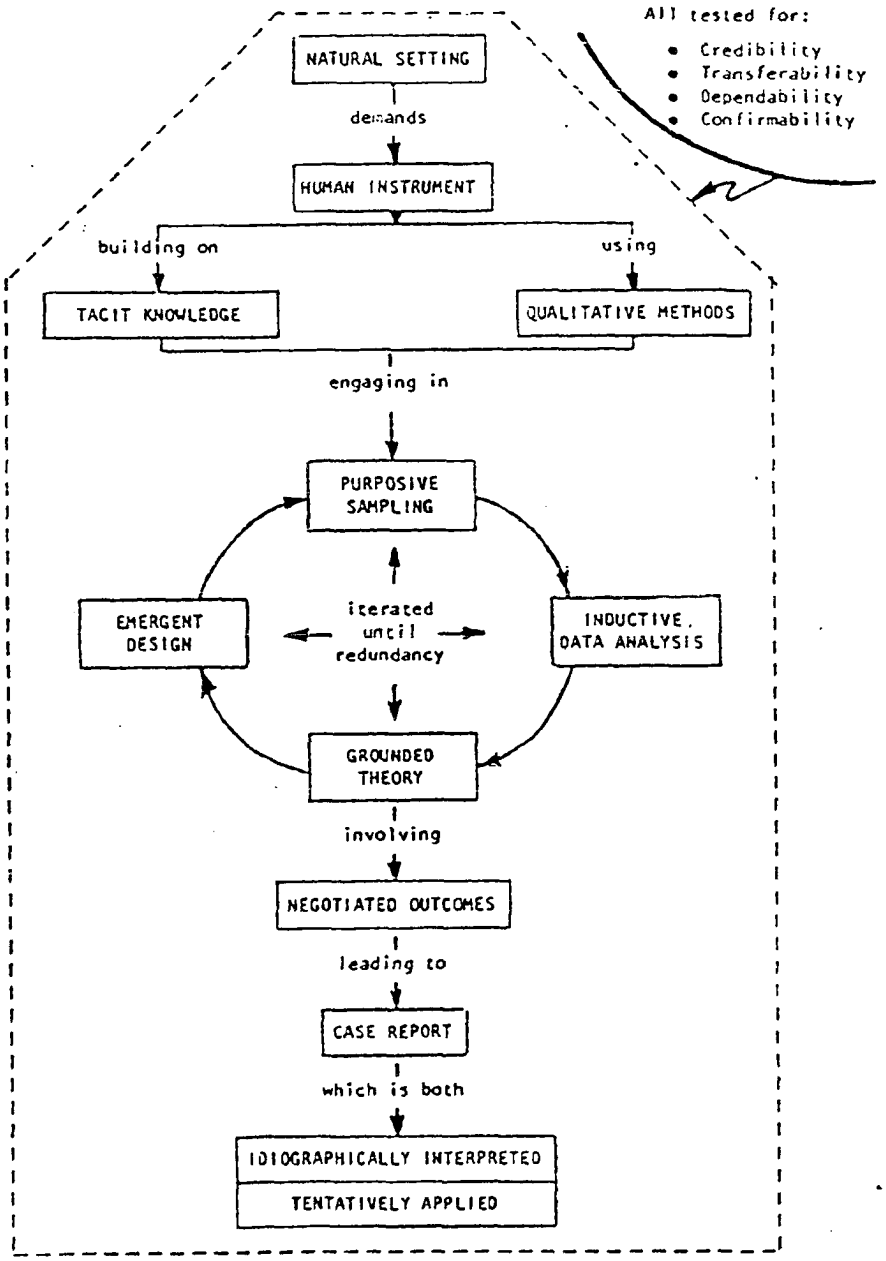

FIGURE 1. Flow of Naturalistic Inquiry.

(Lincoln & Guba, 1985, pg.188)

attempting to understand why actions take place, to assess the subject's reactions to questions and to explore how environment impacts behavior.

In a study such as mine, direct observation would require following subjects for an extended period of time and recording events and outcomes as a person's career develops from technologist to general manager. I did not have the time or means for longitudinal direct observation. Alternatively, I chose research subjects who had attempted the transition to general management. The interviews looked back at the career development of each subject and extracted information relevant to the research question.

In order to incorporate the natural setting, I made observations beyond just the direct answers to interview questions. The interviews were held, to the extent possible, in offices where the individuals work.(see Figure 2) I observed and recorded the subject's attitudes and reactions to interview questions. I probed, as much as possible, their recalled feelings at key points in their careers. I also probed into the company environment and culture to determine how these may have impacted subjects' learning and development.

Human Instrument. The researcher as the primary data gathering instrument is an important and powerful characteristic of qualitative research. The researcher goes into the natural setting for thorough, persistent observation and data collection. Data are recorded using notebooks, journals, field notes, memos, photos, audio/video tapes, transcriptions and similar means of capturing data. The human is uniquely qualified to act as the qualitative research instrument due to the characteristics of responsiveness,

adaptability, holistic emphasis, knowledge base expansion, immediacy of data processing, opportunities for clarification and summarizing, and opportunities to explore typical or idiosyncratic responses.(Lincoln & Guba, 1985). Used appropriately, the human instrument can reach levels of validity and trustworthiness similar to that of standardized tests and mechanical instrumentation. The human excels in recognizing, recording and adapting beyond original data gathering intent.

I was the sole interviewer and observer. Data were recorded using written notes and audio tapes. The audio tapes were the primary mechanism for recording data since much more data could be preserved in a short time period. Not only are words recorded, but the tape also captured vocal tones, some nervous mannerisms, and other audible reactions. My observations of the individual were also recorded in a notebook and provided backup to the tape. The notes also allowed me to capture key statements and actions that take place during the interview. When interesting events or comments occurred during the interview, I adapted the questioning to further probe and clarify the issues. Since the prolonged exposure for thorough and persistent observation of a longitudinal study was not possible in this study, I utilized shorter encounters and multiple case studies. Data were analyzed using the case cluster method (McClintock, Brannon, & Maynard-Moody, 1979).

Tacit Knowledge. Qualitative inquiry also builds on the tacit knowledge of the researcher. Tacit knowledge comes from experience, and can be built upon to gain greater depth of understanding and inquiry. It relies on the ability of the interviewer to recognize key triggers for probing and understanding. Recognition of body language,

nervous idiosyncrasies, or similar nonverbal cues can key the researcher to important areas that require better understanding. Does the tone of a meeting change significantly due to the presence of one individual? Is there an unspoken "pecking order?" What cues or critical incidents should be looked for and trigger the researcher to explore deeper? Everyone has some level of tacit knowledge that allows recognition of such cues. The researcher develops and uses this capability to improve research methods.

My own background of over 20 years in both broad-based technologies and general management, provided a tacit knowledge base that was particularly suitable to researching this question. I have a vocabulary and experience that gave credibility to my probing, promoted rapport, provided a communications base between myself and the interviewees, ability to recognize and respond quickly to statements, and focused inquiries for revealing data. My tacit knowledge made each interview more efficient and effective as I did not have to spend extensive time establishing a common basis for interaction with the subjects.

My background could also have been a detriment. When an interviewee responded to a question, I could not let myself assume that I understood the answer in the context of my own experience. I had to ensure that my record of the responses had sufficient depth so that I could capture the interviewee's context and background.

Qualitative Methods. Qualitative methods are extensions of normal human activities of looking, listening, speaking, and reading. Data gathering is in-depth and well documented. The primary methods of qualitative data gathering are observation, interviewing and document searches. Observation includes gathering both verbal and

nonverbal data. Data must be carefully recorded to cover all that is seen, understood, or requires further action to understand. Interviewing can cover a broad continuum including informal conversational interviews, guided interviews, open-ended interviews, and closed, fixed response interviews. The characteristics, strengths and weakness of each of these interview approaches are presented in Table 3.

Document searches include reading any records that can supplement interviews. This can include, but is not limited to, meeting minutes, presentations materials, planning documents, personnel files, photos, resumes/CV's and other historical records.

The interview guide approach (Item 2 of Table 3) was my method for conducting these interviews. Of all of the choices, this method provided the best mix of structure and flexibility. In this method, the key topics and issues are specified in advance of any meetings to assure that all areas are identified for exploration, but sequencing and wording may have to change depending on specific situations. For example, I was able to insert questions for clarification. As new issues arose during the course of the interview, this method allowed me to pursue a particular direction of inquiry in order to gain a greater depth of understanding.

Appendix A contains the guiding questions that I developed for the study. The general question section occupied the most significant time as I gathered data for each position that the research subject had experienced and searched for key events and skills. The interview discussion began with the decisions that the subject made in choosing a technical beginning. Then the interview probed career learning and development beginning with the first position in each career and proceeding through all career

Type of Interview	*Characteristics*	*Strengths*	*Weaknesses*
(1) *Informal conversational interview*	Questions emerge from the immediate context and are asked in the natural course of things; there is no predetermination of question topics or wording.	Increases the salience and relevance of questions; interviews are built on and emerge from observations; the interview can be matched to individuals and circumstances.	Different information collected from different people with different questions. Less systematic and comprehensive if certain questions do not arise "naturally." Data organization and analysis can be quite difficult.
(2) Interview guide approach	Topics and issues to be covered are specified in advance, in outline form; interviewer decides sequence and wording of questions in the course of the interview.	The outline increases the comprehensiveness of the data and makes data collection somewhat systematic for each respondent. Logical gaps in data can be anticipated and closed. Interviews remain fairly conversational and situational.	Important and salient topics may be inadvertently omitted. Interviewer flexibility in sequencing and wording questions can result in substantially different responses from different perspectives, thus reducing the comparability of responses.
(3) Standardized open-ended interview	The exact wording and sequence of questions are determined in advance. All interviewees are asked the same basic questions in the same order. Questions are worded in a *completely* open-ended format.	Respondents answer the same questions, thus increasing comparability of responses; data are complete for each person on the topics addressed in the interview. Reduces interviewer effects and bias when several interviewers are used. Permits evaluation users to see and review the instrumentation used in the evaluation. Facilitates organization and analysis of the data.	Little flexibility in relating the interview to particular individuals and circumstances; standardized wording of questions may constrain and limit naturalness and relevance of questions and answers.
(4) Closed, fixed response interview	Questions and response categories are determined in advance. Responses are fixed; respondent chooses from among these fixed responses.	Data analysis is simple; responses can be directly compared and easily aggregated; many questions can be asked in a short time.	Respondents must fit their experiences and feelings into the researcher's categories; may be perceived as impersonal, irrelevant, and mechanistic. Can distort what respondents really mean or experienced by so completely limiting their response choices.

TABLE 3. Variations in Interview Instrumentation.
(Patton, 1990, pg. 288-289)

positions. This sequence allowed me to determine both the learning experiences that played a role in the subjects' career development and the transition points in the career path. My approach was influenced by the findings of McCall, Lombardo and Morrison (1988), in which they documented the impacts of key events on management development. From their interviews, McCall *et al* concluded the greatest experiential elements in management development fall into the three categories of: assignments, other people, and hardships. The questions that I outlined in Appendix A were established and followed to provide an indepth look into these categories.

Iterative Research. Qualitative research methods include the iterative process of purposive sampling, data gathering and analysis, and looking for convergent results that will yield grounded theory and emergent design. Subjects are chosen with a purpose. Sampling is focused to the context of interest. Patton (1990) identifies sixteen types of purposive sampling. For this research study, I chose a combination of typical case sampling and stratified purposeful sampling.

To obtain data that could draw a line between successful and unsuccessful transition, I began the research selection process by selecting typical subjects that had a common background of careers that began in a scientific or engineering activity. The stratified purposeful sampling was utilized to choose both individuals that have successfully moved into general management and those that remained in technical positions either by choice or failure in career progression.

Selection of subjects. A key activity was obtaining the purposive sample by identifying and gaining access to individuals who would become the subjects of this

research. Through professional contacts and organizations, I identified individuals as potential candidates. The Silicon Prairie Technology Association in Overland Park, KS has a broad membership that met my research criteria and the Executive Director provided recommendations of individuals to study who had successfully moved from technical to general management roles. I also contacted various individuals from within my personal network of business associates. As I interviewed subjects, referrals were obtained for additional individuals that they felt fit my criteria. I included subjects from a mix of small, medium, and large organizations; and a broad geographical distribution throughout the U.S.(see Figure 2). Although this mix was not a prerequisite, I anticipated that a broader base of subjects might suggest some differential influences, leading to broader outcome transferability. The formal educational background of all subjects is summarized in Table 4. All met the requirement of having begun in a science/engineering discipline.

Data accumulated from the study were analyzed inductively and placed into various subsuming categories. As information became redundant and convergent, theories and designs emerged. Note that a qualitative study does not necessarily begin with *a priori* theory or hypothesis testing. The theory emerged from the data and became grounded in the data (Glaser & Strauss, 1967).

My study uses 18 cases. I conducted single, in-depth interviews with each representative of the research subject pool. Although the process iterated as I proceeded through the interviews, later, supplemental interviews were not required thanks to the significant depth of the recorded data and the breadth of the information that resulted.

Geographic Distribution

- General Management

  Missouri (4)
  Kansas (4)
  Ohio (2)
  Florida (1)
  New York (1)
  New Jersey (1)

- Technical

  Georgia (1)
  Missouri (1)
  Ohio (1)
  New Jersey (1)
  Kansas (1)

Size

< $50M	- Four
$50-200M	- Seven
> $200M	- Seven

Industry

Power
Telecommunications
Biotechnology
Research
Medical Technology
Electronics
Nuclear
Entertainment
Consulting

FIGURE 2. Research Subject Demographics

Subject	Undergraduate	MBA	MBA Studies	Other Masters	PhD
GMgt.1	engineering		X		
2	science	X			
3	science			X	X
4	science				X
5	engineering	X	X		
6	engineering		X		
7	engineering			X	X
8	engineering				
9	engineering			X	X
10	engineering	X			
11	engineering	X	X		
12	engineering				
13	science			X	X
Tech.1	engineering				
2	engineering			X	X
3	science		X		X
4	science/business			X	
5	engineering	X		X	

TABLE 4. Formal Education of Subjects

The primary data analysis of these studies followed the constant comparative analysis method detailed by Glaser & Strauss (1967). In this method, analysis began during the data-gathering phase, preliminary results began to emerge, multiple cases were studied in an effort to establish these results as a repeated outcome, and differences were also evaluated on a constant comparative basis to yield the final theories. McClintock, Brannon & Maynard-Moody (1979) argue for a case-cluster method where each case is treated as a single unit of analysis, and a grouping of common results from each case is then employed. Both methods were used to analyze the data and answer the research question.

The emergent results were not just the opinions of the subjects regarding the role education played in their career transition. Most of the interview time was spent looking into the experience and key events in the individual's career from beginning to their current positions. This time span covered what I refer to as the transition period of the subjects' careers. I gained a thorough and in-depth understanding of the intentional interventions, mediating factors, learning, etc. that affected the career movement of each subject and, wherever possible, I allowed the elements of education to emerge from the data. Each subject directly addressed the research question, but only toward the end of the interview after sufficient data had been gathered to ensure the validity of answers to actual experience.

The data were carefully analyzed to (1) rank of learning interventions according to their greatest impact on career transition, (2) learn how content impacted transition and (3) determine when key learning took place.

Ranking. The task of ranking the learning interventions involved documenting the intervention priorities and establishing ordinal values for graphic portrayal of the results. During the latter stages of the interview, the subjects were asked to rank the importance of the learning interventions for greatest impact on career development. These rankings were also compared to extensive amount of additional data to verify consistency of ranking. This analysis is an example of the case cluster approach (McClintock, Brannon, & Maynard-Moody, 1979), evaluating the inputs from the multiple cases and performing comparative pattern analysis (Patton, 1990) to discover where educational activities took place that impacted career transition.

To facilitate graphic portrayal, ordinal values were place on the rankings. The top ranked learning intervention was given a value of "4", with the second priority receiving a value of "3", the next rank a value of "2", and the lowest rank a value of "1." In some cases there was no evidence of learning via a particular intervention. These modes were ranked as NA and given a value of "0." These results are shown in Chapter 4.

Content. As I analyzed, coded and searched for patterns (Patton, 1990) it became apparent that the learning content for successful subjects was definitely different than those that remained in technology. As I analyzed the data, I found that a job title or functional responsibility change could indicate new learning content being applied to a career. But job titles were not the only indicators. I also discovered skills and experiences where a subject recognized that he/she learned something new, brought success in a current task or position, was important in continued growth and

development; but career development did not always result in a job title change. These experiences involved contact and involvement with others and a learning and action that went beyond the subject's current technical job assignments. As these results are addressed in Chapter 4, I identify the various characteristics that were observed in the multiple research subjects. A subject did not have to have learned all of the subelements that may have been noted under a particular category in order to receive credit. But I did verify that some of the subelements were learned and continued to be developed in the career.

Recognizing the various skills was sometimes quite simple as the interviewee would directly relate experience in a particular area such as contract management. Other times, I would utilize my tacit knowledge (Lincoln and Guba, 1985) to extract the skill from the supporting data. For example, the research subject would relate experience in binding agreements, terms and conditions, negotiations, proposal evaluations, and similar terms that indicated experience in contract management.

Timing. The final variable analyzed was the relationship between the time when educational interventions took place and their relative impact on career transition. I found the time into a career was a stronger indicator than time relative to a transition point. Therefore, I measured the number of years into a career when the initial skills determined in the "content" area were learned. This measurement does not relate to when transition took place. This research looks at when education takes place that result in a transition to general management, not when promotional outcomes may result from that education.

As careers developed, it was obvious that in order to sustain general management capability that learning continued with greater depth and complexity. This research was limited to the transition, and therefore analyzed when skills were first learned to impact that transition.

Case report. The final step of the qualitative process is writing the case report that is thick in description and provides an understanding of the context at the time of the research. When multiple subjects are involved the report can take the form of 1) a series of individual reports, 2) a series of individual reports with an additional summary report, or 3) a single integrated report. (Yin, 1989) This dissertation has integrated the results of the multiple studies into a single report.

Sections of this report contains quotes from the various interviews to contribute to the clarity of understanding of the findings and discussion. The transcribed data frequently contained grammatical errors as it was generated directly from the recorded conversations. In agreement with the interviewees, any quotes that have been used in this dissertation have been corrected for grammar errors and readability.

Negotiated Outcomes. Facts and interpretations that ultimately become a part of any report are negotiated outcomes that are subject to scrutiny by respondents who earlier acted as subjects. The researcher sets out to construct an understanding of an environment. The researcher must take steps to maintain the trustworthiness (see next section) of the data and remove any personal biases or misunderstanding. The results are a reconstruction of the interviews, observations or document reading. Have the data

been accurately recorded and analysis to outcomes been properly performed? This is a point of testing and credibility from the eyes of the subjects.

In this study, all interviews were recorded and tapes transcribed by the researcher for documentation and analysis. Each subject received a copy of their interview transcript so that the subject could review the data, correct any errors, clarify issues, or supply additional data that may yield a more accurate understanding. The corrected transcripts were used for the final data analysis and writing the results. Subjects will also receive a copy of the integrated report.

Trustworthiness.

The qualitative research process, documented in Figure 1 and discussed above, has been proven through extensive usage, to maintain trustworthiness of results. Conventional criteria for trustworthiness are internal validity, external validity, reliability, and objectivity. Lincoln & Guba (1985) pose four new terms for qualitative, naturalistic inquiry: *credibility, transferability, dependability and confirmability*. This study is designed to maintain these qualities.

Credibility is achieved through five major techniques. First, prolonged engagement/interviews, observation, document analysis and triangulation make it more likely that credible findings and interpretations will result from the study. As stated earlier the prolonged interviews were accomplished through multiple case studies and case cluster analysis. Second, peer debriefings were completed throughout the study to allow for an external check on the inquiry process. Third, negative case analysis (technical track subjects) was performed as required in order to refine working and

emerging hypothesis as more and more information becomes available. Fourth, accurate records were maintained and referential adequacy allowed the checking of preliminary findings and interpretations against raw data. And fifth, there was direct checking of results as subjects become evaluators during negotiated outcomes.

Transferability is the equivalent to external validity or generalizability. Lincoln and Guba (1985) stated that the only thing that is generalizable is that there is no generalizability. Their position and that stated by Firestone (1993) is that it is up to the reader to transfer applications or make generalizations to their particular settings by understanding the report descriptions. Eisenhardt (1989) and McClintock, *et al* (1979) build generalization as a step by step process building through multiple case studies, or the case cluster method. This study maintained diversity of research subjects and then looked for convergence of characteristics via the case cluster method (McClintock, Brannon and Maynard-Moody, 1979) in order to provide for transferability.

Lincoln and Guba (1982) propose that dependability and confirmability can be established through maintaining proper records that are auditable. First, close adherence to established qualitative methods and process was maintained and considered essential for dependable data and results. Second, the products (data, findings, interpretations, and recommendations) are analyzed to confirm that the data are internally coherent and result in the conclusions that were obtained.

CHAPTER 4

RESEARCH RESULTS

As I analyzed the results of the research, I discovered that: (1) the pattern of learning interventions along the educational continuum is different for those that made a successful transition versus those that did not. The learning for those that successfully made the transition was weighted toward the experiential end of the continuum, (2) the key educational content for those who successfully made the transition is cross-functional, and (3) this cross-functional education takes place early in a career.

Learning Intervention Priority. During the data gathering interviews, each subject was questioned about the skills and experiences that were learned, developed and applied throughout their career. The interview probing began at the beginning of each persons career and examined skill development up to the date of the interview. Covering the entire career made sure that data were discovered pre-, during, and post-transition. This questioning direction was looking for key events that impacted individuals development toward management (McCall, Lombardo and Morrison, 1988). Towards the end of the interview, the subjects were given the taxonomy of the learning interventions (Table 1). Subjects were asked to indicate where on the continuum their

Subject	Formal	Non-Formal	Informal	Experiential
GMgt.1	3	1	2	4
2	1	2	3	4
3	2	1	3	4
4	2	1	3	4
5	2	1	3	4
6	2	1	3	4
7	2	1	3	4
8	2	1	3	4
9	2	1	3	4
10	3	2	NA	4
11	3	2	NA	4
12	2	1	3	4
13	2	1	3	4
Tech.1	4	1	3	2
2	4	2	1	3
3	3	2	NA	4
4	1	2	4	3
5	4	1	2	3

TABLE 5. Educational Priority Along Continuum.

particular career was impacted. Table 5 shows the results of their responses with a "4" indicating place for highest learning and a "1" the area of lowest learning.

The median numerical rankings for both the general management and technical subjects are graphically displayed in Figure 3.

As I interviewed subjects the emphasis on experiential learning was consistent and strong. Of the 13 general management subjects, all ranked experiential as the intervention of greatest impact on their career, whereas only one of the technical subjects ranked this intervention highest. The responses of all of the subject rankings are shown in Appendix B. A sample of the general management responses is shown below:

(1) "Experience has always been the best teacher."

(2) "A large part of what I do now (as a general manager) was learned through experience."

(3) "It became clear that my early experience was worth about half an MBA."

(4) "As situations come up, you think about how this person or that person might deal with it and you make a choice. Clearly, in the school of hard knocks, learning from experience."

(5) "My boss would worry about the fact that I didn't have a box checked in my experience card yet. He wanted to find an assignment for me that would enable me to do that so he could say, 'yes, he has the experience as well.'"

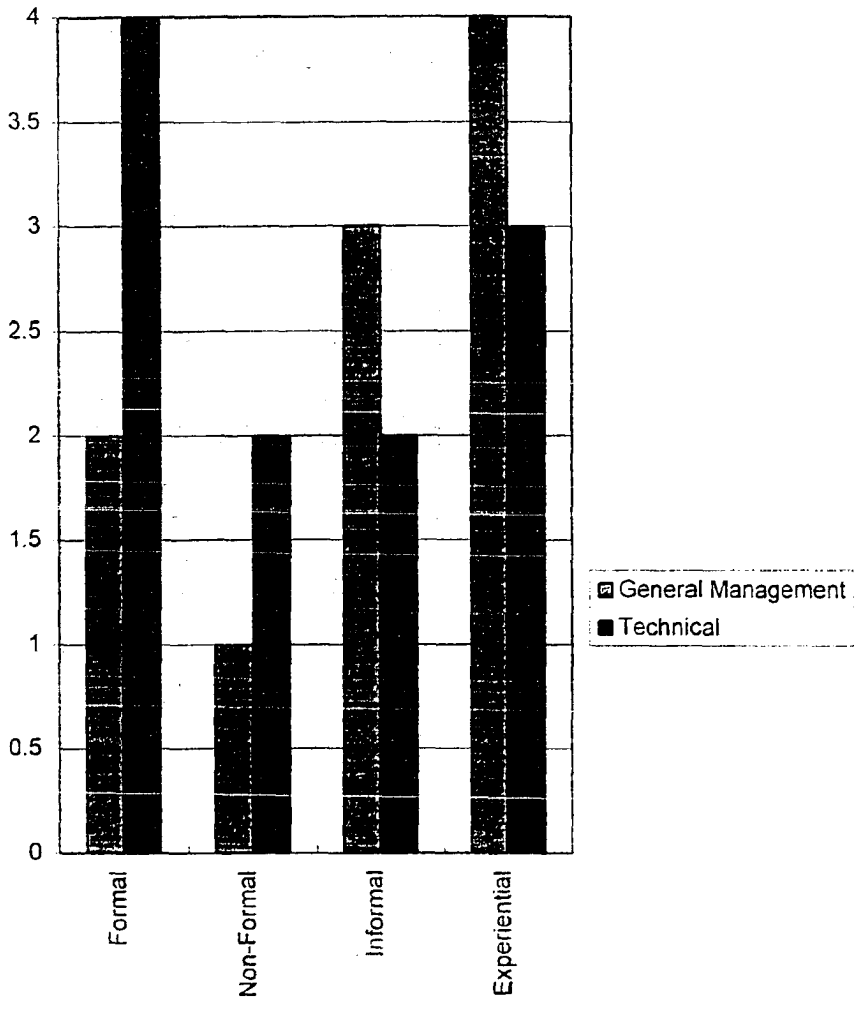

FIGURE 3. Ranking of Learning Interventions.

Eleven out of thirteen general management subjects indicated that they had some form of mentoring during their career. Ten out of those eleven ranked informal interventions second in importance. On-the-job training experiences and mentoring were given credit for strong impact to career development. Two of the subjects linked the mentor as a 'sponsor' to their experiential interventions.

> (1) "In my career, I could either find ways, or my boss (sponsor) could see ways, of developing in a way internally (experientially) without having to go outside to acquire those skills. Maybe through working on a project with somebody. By doing things like that."
>
> (2) "My boss (sponsor) would worry about the fact that I didn't have a box checked in my experience card yet. He wanted to find an assignment for me that would enable me to do that so he could say, 'yes, he has the experience as well.'"

Of the 15 subjects that had a mentor intervention in their career, all of the general management subjects and three of the four technical subjects were mentored through an informal relationship. This pattern is consistent with the findings of Chao, Walz and Gardner (1992) that the results of mentoring, when measured by higher levels of career progression, were greater for informal relationships that develop through natural relationships than for formal mentoring where mentors are assigned by company programs.

Formal education ended up rated third for the general management subjects. But the subjects did not report that formal education in technical areas provided the impetus

to their career development. Instead they consistently saw formal education as a foundation or "ticket."

(1) "Writing skills, reading skills, speaking skills, philosophical analysis, logic... those things that I picked up through my formal education... stood me in very good stead and .... usually made me stand out. My engineering program put me in philosophy classes, logic programs, heavy writing and speaking. In a lot of other engineering curriculums that my co-workers went through, none of that existed."

(2) "Formal education gave the discipline of learning how to learn.

(3) "Formal education is a foundation. The formal side of engineering was learning where to go to get information when you need it. Very few things that you encounter five to ten years into your career, or later, is like your formal education. But you have to have that foundation to know where to draw on specific skills for dealing with problems."

(4) "The formal education was the ticket that allowed me to be considered for other thing."

(5) "A master's degree as expected of someone in my job and a Ph.D. was a lot better. Formal training in a scientific or engineering profession was essential to getting me into the organization. The importance of that diminishes over time, clearly, as one becomes a manager and is more and more removed from scientific work."

(6) "It was a ticket. Without that ticket to open the door, I wouldn't have been exposed to anything."

(7) "It's a threshold situation. I have academic credentials that open doors. I believe that, in reality, is just about all they're good for. Beyond that all that I've achieved and positions that I've secured have been based on education other than formal education."

This attitude of the general management subjects held true even for those that had master's level management studies and degrees.

Non-formal training not only rated last for 12 out of 13 general management subjects but was given little or no credit for any career impact at all.

(1) "I have stopped taking seminars. I don't gain much from them. ... Some seminars reinforce things that you already know. .... Some seminars have been entertainment. The presenter was an actor... I left. The value to employees is a reward in recognition ...that you are giving them a great complement by spending money on them."

(2) "I've always been so busy that I couldn't fit them into my schedule. I never felt there was the right subject matter that I wanted to go learn about. I was always busy doing something else. Learning through experience."

(3) "I didn't go to those (seminars) until I had been a manager a while. I didn't have a lot of seminars and special short course stuff and things

like that in my early management. Most of that stuff came late (in my career)."

(4) "I don't have time for anything like that. I don't even have time to read a book except when I am on an airplane."

The general position of the subjects was that seminars and non-formal education played no role in a successful career transition. This finding supports the position of Gordon (1991) that the effectiveness of management seminars and "soft-skill" courses is questionable. Whether or not seminars could or should have an impact on sustained general management capability was not evaluated and should be further evaluated in future research.

The technical subjects had a different attitude toward non-formal education that was well summarized by this comment:

(1) "Seminars always influenced us. Technical seminars came into play time and again preparing you to do jobs. ...You can force the (seminar) selection by knowing somebody in the country is an expert and asking them to conduct a seminar to meet your specific needs. ..Technical seminars permitted you to do your job better. ...Those were the easiest seminars to evaluate because there was an immediate impact to a job situation if they could be focused on exactly what you would be working on."

Even though this area was not ranked near the top with regard to career progression for the technical subjects, all of the technical subjects stated some level of importance in

maintaining technical skills and knowledge as they kept up with the rapid movement of technology. Value was stated for those that remained in a technical career for seminars that expanded levels of technical capability. The immediacy of impact, incorporation into current activities and specific technical needs supports the research conclusions of Gordon (1991); Wallace (1993); and Smock (1993). The attitude of technical people who attended management seminars though was about as poor as the general management subjects.

> (1) "In some areas of management where you attend management seminars, you don't know the next day what exactly you got from that seminar. You may not know for six months. It's tough to evaluate those seminars as to their value."

Outliers

Differences and exceptions were also evaluated on a constant comparative basis (Glaser & Strauss, 1967). There were noted exceptions of general management subjects 1, 10 and 11 not rating informal education as their second priority. As the following comments indicate, subjects 10 and 11 did not identify any form of informal education in their career.

> (1) "I feel a void in my life for not having a real strong mentor throughout my career. ...I've not really had that mentor relationship.'
>
> (2) "I've had a real problem with mentors. I really haven't had any. ....I've always been rather unhappy about that fact."

Both subjects expressed a sense of loss or void in not being able to identify a mentor anywhere in their career. Because of these statements, I did not assign a rank for informal education in their cases. Instead I declared them to be NA (not applicable).

General management subject 1 gave a higher priority to formal education. This subject was a senior manager in a technical consultant company. Their business is selling the time of their technical experts. This particular individual moved into general management but in order to sell his own time he also had to maintain his technical capability and avoid obsolescence. Therefore he had a different priority pattern that balanced learning general management skills experientially while continuing to strongly utilize and develop his technical skills through formal training. This balancing of the dual responsibilities resulted in a learning pattern that mixed general management and technical learning patterns.

General management subject 2 also ranked non-formal training above formal training. As was the case with subject 1, this also was a situation that was unique to his career development. As he transitioned into general management, he also moved into a business which was outside his specific technical background; he moved from an engineering environment into managing real property assets for high tech usage. This move caused him to take seminars to obtain specific knowledge in property management and to qualify for a formal industry, professional certification. This career change is reflected in his learning pattern.

Educational Content. The second independent variable that I analyzed indicated what was being learned and applied in a career for a successful transition from

technologist to general manager. The results, shown in Table 6, reveal that there is a strong cross-functional learning component that separates general management from technical. The learning categories that I consistently noted from the research were: people skills, project management, finance, marketing/sales, operations, contract/procurement/legal, quality, and international. These differences became apparent during the first eight years of employment after entering a professional career. Initial learning of these cross-functional components took place both before and during the actual career transition.

As I analyzed the research data, I did not key on changes in title or functional responsibility over the career path, although those could definitely be predictor variables. I discovered skills and experiences from which a subject recognized that he or she learned something new that brought success in the current task or position and was important in continued growth and development. These experiences involved contact and involvement with others and a learning experience or activity that went beyond the subject's immediate technical job assignments. I identified all of the various characteristics that were observed in the multiple research subjects and grouped the various characteristics under skill category headings. A subject had to have learned some, but not all, of the characteristics noted under a particular category in order for the category to be counted. I did verify that a significant portion of the characteristics were learned and continued to be developed in the career.

Recognizing the various skills was sometimes quite simple since the interviewee would directly relate gaining experience in a particular area, e.g. contract management.

Subject	People	ProjMgt	Finance	MktSale	Operation	Contract	Other	Time
GMgt.1	X	X	X	X	X	X	I	6
2	X	X	X	X	X	X	I	8
3	X	X	X	X	X	X		5
4	X	X	X	X	X	X		6
5	X	X	X	X	X	X	Q	5
6	X	X	X	X	X	X		5
7	X	X	y	X	X	X		6(10)
8	X	X	X	X	X	X	Q	7
9	X	X	X	X	X	X		4
10	X	X	X	X	X	X	Q	8
11	X	X	y	X	X	X	I	4(6)
12	X	X	X	X	X	X		3
13	X	X	X	X	X	X		6
Tech.1	X	X						
2	X	X						
3	X	X	y	X	y			(12)
4	X	X	y				I	(12)
5	X	X	y		y			(15)

X=Early experience in area

Q=Quality experience

y=Later career experience

I=International experience

( )=time to later career experience

TABLE 6. Management and Functional Experience Matrix.

Other times, I would utilize my tacit knowledge to extract the skill category from the supporting data as the interviewee would relate experience in binding agreements, terms and conditions, negotiations, proposal evaluations, and similar terms that indicated experience in contract management.

A technical expertise category was also apparent from the data. But this was not considered a growth area since this was a requirement of the dependent variable. However, I did recognize a shift in the pattern of responses that related to technical skills for the two groups of subjects. Those who were successful in making the general management transition had some technical growth and development within the first few years of their career, but as they made the transition the importance of technical skills diminished to varying degrees. Predictably, the subjects who remained in technical positions showed a pattern of maintaining or strengthening their technical skills.

To recognize the differences that were found, it is important to look at what was noted in each category.

People skills. Every research subject recognized the importance of other people in the successful completion of job requirements. One subject summarized it well: "It's a skill that everyone has to learn. How to get things done through others." As subjects commented on this part of their development, they listed skills and experience of: supervision, working with others to coordinate tasks, motivating others, encouraging others, working to solve colleague's personal problems, personnel development. Each subject identified human relation skills and human interaction skills being expanded during the transition from a formal education world to their professional career. There

was no difference between technical and general management subjects in their responses concerning people skills. There was one instance among the technical subjects in which the individual recognized and developed people skills, but refused to do personnel administration.

Project Management. Within this category, I grouped the various skills of scheduling, directing, planning, budgeting, organizing, critical path networking, and other PERT (project management evaluation and review techniques) type management tools. This category was limited to learning experiences that occurred within the functional area of the particular subject. Again, this developmental area was identified by all subjects as being important to their career progression and did not separate the general management subjects from the technical subjects.

The two categories of people skills and project management were identified by Lewey and Davis (1987) and Medcof (1985) as classes of management skills that technologists have to develop as they move to management, regardless of whether it is general management or technical management. My research data supports those positions. The data show that subjects recognize the need for these skills regardless of their management path. Additional learning is necessary to separate those that move into general management. The categories that follow would be identified by Wheelwright and Clark (1992) as representing cross-functional skills. These skills were demonstrated in a manner that showed a distinct difference between technologist and those that move into general management.

Finance. As I analyzed the data for this category I was looking for something beyond project budgeting. I recognized exposure and development that went across functional boundaries for a broader understanding of business operations. What I found was ability to read, understand and respond to a balance sheet, cash flow management, pricing decisions, investment analysis, asset utilization, return on assets analysis, and pursuit of outside funding.

This area shows a definite difference between general management and technical subjects. All of the general management subjects gained experience in finance within the first ten years of their professional career. Two of these were identified as later career experience only because there was a gap between other experiences and when this particular ability was acquired. But this skill for all successful general management subjects was definitely earlier than any of the technical subjects. All of the general management subjects continued to develop and expand skills and responsibilities that involved financial operations as their career progressed.

The technical subjects had a different pattern. Only three of the subjects displayed financial learning that was cross-functional and these learning experiences did not take place until 12 to 15 years into their career. The involvement also appeared to be more restricted in later years as each technical subject learned to use the financial information to enhance only technical operations and did not show an impetus to move to organization wide financial deliberations and responsibility.

Marketing/Sales. Analysis of the data revealed some subjects with direct job assignments in roles of technical sales engineer, applications engineers, marketing or

sales. This made for easy evaluation of this category for their career. However, others had experience that required identification of marketing/sales tasks rather than a job title:

> (1) "We would travel to visit customers. We would respond to a request for a new product idea. At the development lab, we put together plans and a rough design of what could be done. Cost estimates were created. The package was sent to the customer in the form of a development proposal.... Problems were resolved and the deal closed."

My tacit knowledge of the process allowed me to recognize the tasks involved in the marketing/sales process and properly categorize the data. There were many instances that were extracted from the data that demonstrated interface and activity with the customer for the express purpose of new product development and market development.

This analysis again showed a difference between general management and technical subjects. Only one of the technical subjects had any early experience in marketing/sales and that subject had some strong reservations on having that as a job requirement:

> (1) "I was introduced to marketing. I got to go out and talk to the customers... .I like the people interface. ...But I was always a part of the engineering team."
>
> "(Later), I was asked to transfer to marketing. They needed somebody that knew technology. I didn't move. I didn't have a good impression of them (marketing)."

"(Later), I agreed to do it (move to marketing) for a couple of years to help set up a new position. There was no intent of staying. ... It was not attractive. I moved reluctantly. By and large I would say I was not successful."

This subject was involved in marketing at least three different times over a seventeen year period of a career. Each time there was an expressed hesitancy except for enjoying talking with other people and trading technical ideas. Each time the subject chose to stay in engineering or chose to return to engineering after a short tenure.

Operations. This category identified learning experiences that demonstrated new capabilities in an operational area. Since subjects came from both service and manufacturing industries, it was necessary to include activities for delivering both products and services within the operations category. The individuals moved beyond technical developments to responsibility for meeting contractual deliveries, understanding the interaction of both product and process, and responsibility for company order delivery measurands.

Early career learning in operations was distinctively different for all general management subjects, but not for the technical subjects. There was evidence of operational responsibility in two of the technical subject's careers during the 12 to 15 year experience points. But in each case the individuals continued their technical focus and moved back into engineering tasks.

Contracts/Procurement/Legal. This category evaluated learning in situations where the outcome was legally binding documents that impacted business. This learning

was demonstrated through activities on either a subcontracting/procurement side or the customer side. Credit for development in this area required going beyond technical requirements definition or specifications. Technical subjects stated that they sat in negotiations to come up with technical terms and conditions, but they had no part in the legal terms and conditions. General management subjects went beyond this level to participating in operational and legal negotiations, determining payment issues and legal risks or directly leading negotiating efforts. Movement beyond the technical scope was missing from the technical subjects resulting in a difference in the learning content from the general management research subjects.

Other. Within this area of Table 6, I have noted the functional capabilities of international business knowledge and quality management. These categories were a distinct part of the careers of the individuals with these skills. In chapter 5, I will discuss the potential significance of these skills.

Wheelwright, S. & Clark, K. (1992) present a case for cross-functional teams and skills for successful personal and corporate performance and growth. The results of Table 6 supports their position that cross-functional personal career development is a key part of successful general management development.

Other emergent results

As I analyzed the interview data I also noted three other areas related to content learning that emerged from the data and resulted in differences between general management and technical career paths. These are: (1) choice, (2) resulting attitudes and (3) mentor content.

Choice. As technologists began to make the successful transition to general manager there was a need to make a definite choice. Some knew in high school and college that they wanted their career to move in a general management direction, but they chose to start that career from a technical base. Others had to make that decision during their career.

(1) "There was a need and I couldn't see who was going to provide the leadership. That was a very hard decision for me. I always envisioned myself as a very good scientist. I had to examine goals and objectives that I had. I decided to go the (general) managerial route."

(2) "It was not very satisfying being on a research bench. The bench research was a means to an end for me."

(3) "I wasn't particularly interested in being a technical problem solver. I was definitely interested in more than engineering."

(4) "I never wanted to be the worlds best designer. Engineering in my case was truly a ticket (to general management). ...The way that you see yourself, that's probably what you ought to learn to do."

(5) "That was a major step where you were not going to go back and work on anything really technical. ... A major step that people take at some point where they finally decide that they're not going to be a technical contributor. For me that was moving (to this new position)."

Choices were just as important to the technical subjects:

(1) "Did I want to do something different? That question probably never occurred to me because I was doing what I wanted to do (technical)."

(2) "I was given good work, good technical challenges. Fortunately that was a match for my interest..... There were about three occurrences of turning them down on going into management. They finally accepted the fact that I didn't want to go into management."

(3) "I never even thought of changing. .... I stayed on the technical side predominately."

(4) "I was given opportunities to broaden my experience which would have required relocating. .... I kept turning them down (and stayed in technical)."

(5) "I like the technical aspects of management. I've stayed on that side. ... I moved back into engineering."

(6) "People tried to encourage me to get an MBA. But I really needed the technical education, not management education, to handle my job. ... I never could shake where my true interest was."

Choice drove the learning of skills. For the general management subjects, their choice to move to management pushed individuals to learn beyond technical areas. While the choice for technical subjects was to avoid broadening experiences and strengthen technical skills.

This linking of choice and learning content is supportive of Kohn (1993). Kohn presents a case for intrinsic motivation being superior for obtaining top performance from individuals. He states that three keys to creating conditions for intrinsic motivation are collaboration, content, and choice. Collaboration is people working together to meet common goals. Content of tasks must be meaningful and interesting for the participants. There is greater enthusiasm when individuals are doing task that they chose to do and have some part in the decision process. The results of this research study supports this concept of choice and content.

I found that all of the general management and technical subjects made a choice at some time in their career to either make the transition or to remain in a technical career path. That choice ultimately led to different learning content that each group of subjects experienced. The learning content that resulted from the choices became a differentiator for successful transition to general management.

Attitude. As the transition began to take place there was a change in personal attitude that was seen in the responses of the subjects.

> (1) "We had to think as the General Manager thought....There are selfish interests in all of the functional organizations. I had to act as the General Manager who doesn't hold any (functional bias)."
>
> (2) "I really consider myself a generalist, a General Manager. I'd like to be stronger in every area, but I have no single area where I feel a lack of confidence. I don't have any single area where I think I'm the smartest

guy in the world. ... It (general management) is bringing the right resources to bear on a given issue."

(3)"You're not doing it (detailed functional tasks), but you're watching over it all."

The technical subjects revealed a different attitude.

(1) "I have a lack of tolerance for people who wouldn't deal with technical problems."

(2) "I believe the supervisory area causes technical competence to go down hill. I thought your ability to sell your talents on the street to other companies became limited in that case.... So the career goal was to stay technically competent in the areas I could and to advance as I could on the technical side."

(3) "I took an accounting course and introductory course to management. I didn't like either one of them. ... for what I was doing, it didn't help. Didn't give me any more skills."

This resultant finding supports Medcof's (1985) argument that technologists moving into general management must deal with the problem of adopting a more generalist view.

Mentoring Direction. From the response of the interviewees it was apparent that mentoring had a different impact on the two groups of subjects. Having a mentor could not be distinguished as a difference between the two research subject groups since eleven out of thirteen general management subjects had a mentor, and four out of five technical subjects had a mentor. But the content of the mentoring relationship was different for

those that made a general management transition. The general management subjects were encouraged to pursue experience broadening, management development.

> (1) "The most important mentor was the Chief Engineer. He impacted my career by giving me opportunities that I might not have gotten otherwise. I learned a number of valuable things. One was to look at any issue from the broadest perspective I could. ...by and large we (general managers) need breadth more than we need depth."
>
> (2) "I had several bosses who provided me a lot of encouragement to move into the (general) management ranks."
>
> (3) "(I was mentored to) look forward to advancement and acceptance of broader responsibility. ... You really are capable of much more. You ought to aspire to it (general management). My boss would worry about the fact that I didn't have a box checked in my experience card yet. He wanted to find an assignment for me that would enable me to do that so he could say, 'yes, he has the experience as well.'"

There was also the conscious rejection of mentoring toward technical development by a general management subject.

> (1) "He was looking for jobs for me and pushing me in the direction of staying in the technical side of business. I was not willing to do a post-doc. That was one of the things that ended my technical career. ... I didn't need (want) that."

Reaction to mentoring, as can be seen from the following comments, was different for the technical subjects.

> (1) "I think anybody who even made an attempt in that direction (encouraging general management), as soon as I detected it I probably told them, Go away. Don't bother me. I'm happy with what I'm doing. I basically made known my desires strongly enough and often enough that people never tried to change me in any way. I was valuable as I was with technical skills."
>
> (2) "People tried to encourage me to get an MBA. But I really needed the technical education, not management education, to handle my job. ... I never could shake where my true interest was."
>
> (3) "My boss in '88 started to take an interest in helping me to develop. ... He encouraged me to continue to stay technically proficient. Stay up with where the industry was going technically. Get involved in other technical organizations outside the company."
>
> (4) "No, mentors did not encourage me to a more general management career. They encouraged me to keep moving in the technical line."

From the above data, it was obvious that individuals made choices that impacted their learning content, as changes began to take place the attitudes of the individual changed to foster continuing on the path of transition, and mentoring content had an impact on learning content.

Timing. As I analyzed the final independent variable, I recorded the time when the subjects experienced their initial educational interventions for learning new skills. Since cross-functional skill emerged in this study as a key to general management transition, the timing variable recorded indicates when the majority of the functional experiences were learned (see Table 6). The final column in that table displays the intervention time within each career. I found the time into a career was a stronger indicator than time relative to a transition point. Therefore, I measured the number of years into a career when the initial skills determined in the "content" area were learned. This measurement does not relate to when transition took place. As one looks at the times, the following results were noted: (1) 5.6 year average, (2) 6 years for both mode and median, and (3) the longest time to early cross functional career experience was 8 years.

CHAPTER 5

DISCUSSION

My research addressed the following question: What role does education, in its various forms, play in the successful transition of an individual from technologist to general manager? The specific focus was to understand the ranking of various types of educational interventions, the content of what was learned and applied toward career development, and the timing of key learning interventions. This was an exploratory study of multiple case studies. My analysis revealed: (1) a distinct pattern of ranking types of learning interventions that differentiated general management from technical people, (2) a differential cross-functional learning content for general management individuals, and that (3) early cross-functional learning impacts the transition.

Learning Intervention Patterns. The interview responses recorded in Appendix B were extracted from the negotiated outcomes and resulted in the rankings that were documented in Table 5. For general management subjects, the dominant ranking pattern (most important to least important interventions) was: experiential, informal, formal, then non-formal. For the technical subjects, there was not a definite pattern but the average ranking pattern was: formal, experiential, informal, non-formal. The comparative median rankings of general management subjects and technical subjects are portrayed

in Figure 3. This graphical presentation shows a distinct difference between the two groups of research subjects.

Time spent in an Intervention The responses of general management subjects indicates that the time spent in the various types of interventions was consistent with the ranking pattern. Although my research study did not seek to quantify how much time was spent in any particular intervention, the importance rankings mirror the relative amount of time spent in the different types of learning interventions.

Sorohan (1993) cited research results showing that 90% of learning for all individuals is informal or incidental (experiential). Throughout a career, people spend significantly more time doing tasks and a relatively limited time participating in formal education or non-formal seminars. This observation of the time spent in the unintentional learning interventions of experiential and informal would indicate that the resultant ranking may be driven by time spent in particular learning interventions when not mediated by some overriding factor such as technology obsolescence.

When comparing time spent in informal versus experiential interventions, Table 1 shows that a characteristic of informal intervention is short encounters over a long time period. That times spent in mentoring are significantly greater than for seminars or formal training is as expected, and more time is spent in experiential learning situations than in informal situations.

When comparing the element of time spent in the formal learning interventions to the non-formal, note the responses of the general management research subjects:

(1) "I have stopped taking seminars. I don't gain much from them. ... "

(2) "I've always been so busy that I couldn't fit them into my schedule."

(3) "I didn't go to those (seminars) until I had been a manager a while. I didn't have a lot of seminars and special short course stuff and things like that in my early management. Most of that stuff came late (in my career)."

(4) "I don't have time for anything like that. I don't even have time to read a book except when I am on an airplane."

These responses supported the subject's recollections that the least amount of their time was spent in non-formal interventions.

If one only looks at the element of time spent in each type of intervention, one might also expect the technical subjects to exhibit the same pattern as the general management subjects. But the importance of technical learning and career impacting interventions was heavily influenced by the rapid changes that take place in technology. The results reflect the subject's recognition that the technical half-life, or technical obsolescence, of an engineer is less than five years (Avishai & Taylor, 1989). Since there was a decision by each of the technical subjects to keep their technical capabilities as their key skill area, they articulated a need for continued pursuit of formal and non-formal education as a vehicle to keep up with current technology. Note that among the five technical subjects there were three technical masters degrees and two technical PhD's.

The technical track subjects continually looked for ways to remain technically competent:

(1) "Seminars always influenced us. Technical seminars came into play time and again preparing you to do jobs. ...You can force the (seminar) selection by knowing somebody in the country is an expert and asking them to conduct a seminar to meet your specific needs. ..Technical seminars permitted you to do your job better. ...Those were the easiest seminars to evaluate because there was an immediate impact to a job situation if they could be focused on exactly what you would be working on."

(2) "People tried to encourage me to get an MBA. But I really needed the technical education, not management education, to handle my job."

(3) "My boss in '88 started to take an interest in helping me to develop. ... He encouraged me to continue to stay technically proficient. Stay up with where the industry was going technically. Get involved in other technical organizations outside the company."

Learning Content. As seen in Table 6, a distinct difference in learning content between the general management and the technical subjects has been identified for cross-functional learning experiences. This leads me to conclude that cross-functional learning experiences are essential to successful transition from technologist to general manager. Some rather recent publications have indicated that successful corporations should create situations to stimulate cross-functional interactions between individuals and teams

(Rummler & Brache, 1990; Wheelwright & Clark, 1992). My research indicates that managers who moved successfully from technologist to general manager have already been participating in educational interventions with strong cross-functional content and drove them to cross-functional interfaces.

Breadth Comments made during some interviews indicate that the subjects recognized the need for development of a breadth to their capability:

> (1) "One of the attractive features of my career has been the breadth of responsibility... punched the tickets of engineering, marketing/sales, some kind of manufacturing operation. ... My peers did not have as broad a background in operating responsibility or education for that matter. .... It was kind of demonstrated capability in a variety of situations that people recognized."
>
> (2) "Learning what is expected or demanded... a manager who has grown up form either a task manager or project manager getting into bigger and more complex management issues. You are really growing in the direction of becoming a general manager. .... Someone who is strictly a technical problem solver, those people are just not going to be able to handle the totality of the responsibilities."
>
> (3) "I had success in building and being part of a team that was inter-disciplinary. One guy (a peer) made more money in his department. But he didn't branch out. He was narrowly focused. ... I was promoted over

him because I thought broader. It was the natural way of thinking for me."

(4) "The man who ran the work did not want to interface with manufacturing. He did not want to interface with quality. He wasn't particularly interested in developing good relationships with the customer. ... things he lacked were things that I enjoyed doing. .. I learned from him negatively (what not to do)."

This same thought was expressed by one technical subject who commented on the possibility of moving to general management sometime in his later career. "I need that kind (breadth) of experience to be a manager at the next level."

This research study indicates that breadth of learning across multiple functional areas is important to making a successful transition from technologist to general manager. However, I would not presume to state that breadth of education alone would bring success. For the research subjects that I studied there was a recognition by peers and superiors that broad skills were being developed and appropriately preparing the individuals for continued career growth. Along with broad skills development there also had to be an opportunity to move to a general management position. This opportunity may have existed within a current company or may have required a change in employment to find that opportunity. The general management subjects demonstrated personal initiative to both broaden their skills and pursue career development opportunities in general management. Cross-functional learning continued both during

and after the transition as breadth was strengthened with increased depth and complexity in the skill areas.

General versus cross-functional training The impact of cross-functional skills is confirmed when I directly compare the seminar training of four of the subjects (one general management and three technical). These four research subjects were required to attend a series of management development courses that were put on by their individual companies. These courses were similar for each of the subjects since the subjects were in the same industry and industry management development programs had been established by the recognized industry leader. These courses were courses that dealt with communications, writing, human behavior and motivation, project management, planning, supervisor training. Individuals were required to take these seminar courses during the early stages of their career. Of the four individuals who took these specific series of courses, three remained in technical careers and only one moving to general management. Thus, data do not support a conclusion that taking these general skills courses correlated to the transition to general management.

Over recent years there has been a lot of discussion regarding business needs in our global economy (Capon & Glazer, 1987; Clark, 1989; Morita, 1987; Nadler & Tushman, 1987; Steele, 1989) and the need for improved quality (Crosby, 1992; Walton, 1986; Wheelwright & Clark, 1992). Table 6 shows that I was able to identify that experience and skill development in international environments and in quality was key for some of the general management research subjects. However, there was not sufficiently distinct pattern in the study group to draw any direct conclusions. Instead

a new series of questions were generated. If these areas of quality and international dealings had been a part of career development for general managers would businesses be facing these issues as they do today and be trying to develop new cultures with stronger quality and better global awareness? Would early skills learning in these areas result in better incorporation into management thought and business operations? This could be an area for future research.

Timing. Research shows that early career mentoring directly impacted early career promotions, career satisfaction (Whitely & Coetsier, 1993) and career decisions (Mainiero, 1986). This research study indicates a correlation, regardless of learning intervention, to early career cross-functional skills development that impacts the successful transition from technologist to general management.

The time recorded in Table 6 indicates when the majority of the functional experiences were learned. The final column in that table displays the intervention time within each career when initial skills were learned. This measurement does not relate to when transition took place. It should be noted that transition requires both the recognition by senior management that a capability has been sufficiently learned to allow for promotion and a promotional opportunity must exist. As one looks that the times, the following results were noted: (1) 5.6 year average, (2) 6 years for both mode and median, and (3) the longest time to the majority of early cross functional career experience was 8 years.

There is a clear pattern that breadth of learning early in their career was important for all of the subjects for successful transition from technologist to general

manager. Also, the optimum length of time based on this limited sample would indicate such experience is gained in 6 years or less.

Timing of Interventions It is also instructive to understand when certain learning interventions took place with respect to the successful transition to general management. For the general management subjects I interviewed, MBA studies played a relatively low priority in the transition process. This observation appears to have been partially driven by the timing of these formal MBA learning interventions with respect to the career transition. Six of the management subjects had participated in MBA courses, but five of these individuals participated in those courses after they had had the same experience in industrial experience settings and were either well into or had completed the transition to general management. These courses may have helped in reinforcing knowledge that already existed and sustaining general management capability, but since I was searching for antecedents to successful transition, not sustained capability, I can not link these courses to the research outcome. The only MBA experience that took place at a time in the research subject's career for impacting the transition was for general management subject 5.

Subject 5 still identified formal education as foundational and gave it third priority on the education continuum. This subject's MBA studies took place relatively close to key transition impact learning, but the subject's definite pattern of experience leading and was reported as having greater impact than did the formal. There was evidence that completed work reports and tasks were duplicated to fulfill formal course requirements.

Courses did not drive work practices, but rather, it appears that the work experiences fed into the courses.

CHAPTER 6

CONCLUSIONS AND FURTHER RESEARCH

As stated in chapter 2, formal and non-formal education are an intentional and systematic learning interventions while informal and experiential education results in learning but learning may not be the basic purpose. The subjects who had made a successful transition to general management had a very discernable pattern of greatest impact learning in the area of the continuum where education is not the basic purpose. There was a definite pattern of priority from experiential, then informal, formal, and finally non-formal. This pattern, however, did not exist for individuals who remained in a technical area. Figure 3 makes it obvious that the learning patterns are different between those that transition to general management and those that did not.

As I analyzed, coded the results and compared those patterns, it became apparent to me that the learning content for general management subjects was also different than those that remained in technology. The results, as shown in Table 6, show that there is a strong cross-functional learning component that separates general management from technical. As the research subjects were exposed to learning opportunities that had cross-functional content, the general management subjects chose to move to broader perspectives while the technical subjects chose to concentrate on technical expertise. In

the process of learning process, there also was an added outcome as the attitude among the general management subjects developed into a more general perspective of business issues that considered all functional areas.

When evaluating the timing of key learning interventions, my research provides evidence that early career educational interventions for cross functional development favorably impacts the career of future general managers.

Emergent Theory. Figure 4 is my attempt to portray educational development patterns that resulted for those that successfully made the transition to general management. As I researched the question: What role does education, in its various forms, play in the successful transition of an individual from technologist to general manager?, the following theory emerges:

> For the successful transition from technologist to general manager the optimal educational intervention is to build on one's foundational formal education through a series of experiential and informal interventions that facilitate development of both basic management skills and cross-functional skills. Career choices impact learning content. Attitudes shift and become more generalist in nature. Breadth of learning should be the focus early in one's career with depth and complexity continuing throughout this career.

Figure 4 represents the career paths with educational interventions and learning content that emerged from this study. The wider the line, the more preferred learning intervention for each path. It should also be noted that there may be movement between each path as an individual moves to a choice of where they truly want their career to proceed. I was not able to portray in Figure 4 the decision point for "choice" that I observed in the research subjects. The general management subjects predominantly made their decision to pursue a general management career path prior to experiencing the

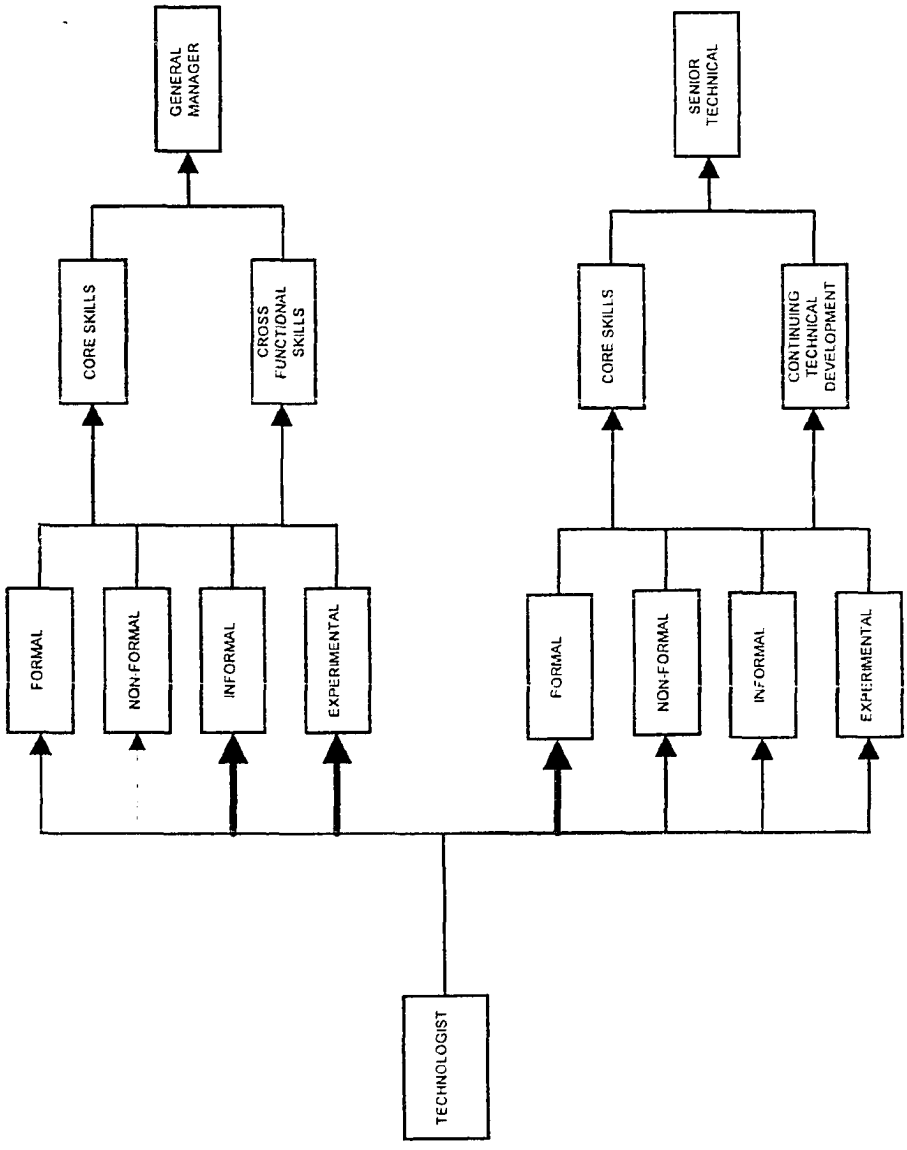

FIGURE 4. Emergent Theory: Educational Role on Successful Technologist to General Manager Transition

cross-functional learning. The technical subjects predominantly were exposed to cross-functional learning activities and chose to return to, or remain in, technical areas.

As individuals work with their employers to develop personal career plans designed to facilitate a career in general management, my research indicates that this is a formula for success. However, one should not think that by just fulfilling this theory of educational interventions that general management success will result. As I stated at the very beginning there are many other factors: such as gender, personality, opportunity, politics, and family, that can also have an impact on career development. This research develops an important base for the educational dimension, but career planning should take into consideration these other factors.

Further research

As I conducted my research, I identified topics that could be the basis of further research: 1) Additional studies to validate and quantify elements of my emergent theory, 2) studies of the role of educational interventions in sustaining both technical and general management capability, 3) research into impacts of mentoring content, 4) evaluating of other learning taxonomies.

Validation of emergent theory Research studies should be developed to test and refine the elements of the theory and look at large samples. These studies could include research into a weighted value for each intervention that goes beyond just ranking, an understanding of minimum levels of learning into cross-functional skills that would impact success, and a sharper focus and quantifying of what timing constitutes early career learning.

Role of education in sustaining management capability Sustaining management skills and position involves a totally different segment of career activities than was studied in this research, but the impacts to individuals and companies can be just as important. Therefore, this question should also have further research.

Mentoring content As documented in Chapter 2, there is a strong literature and research base that has looked at both the process and outcomes of mentoring. The results of this research indicates that there also should be research into the content of mentoring actions and attitudes of proteges to mentoring content.

Other learning taxonomies. Various taxonomies of learning patterns and learning styles have been developed by researchers in education. The data gathered in this study should be analyzed within the perspective of these alternative research framings.

APPENDIX A

Interview Questions

Interview Questions

What caused the person to choose their particular technology course and studies work prior to beginning their career?

General Questions- Asked for each position in a career.

Tell me about your career progression?

What were the key events or critical incidents that triggered each job change?

What was the most important thing(s) (lessons learned) taken out of each experience? Were the actual outcomes the intended outcomes? Develop evidence. How did early lessons impact later career developments?

Business Skills

If skills are necessary but not sufficient, what relating factors (such as hiring someone to fill weakness, or avoiding situations) do allow current managers to successful make the required transition? What separated those that successfully progressed into senior management from those that received skills training but did not rise within an organization?

Personality

Do individuals recognize a role for their personality traits in their career development? Did they consciously identify weaknesses and learn and develop interventions? If so, what about the interventions brought them success that may not have been seen in the performance of their peers who did not continue to advance?

Educational Needs

Was education a trigger for career change, triggered by career change or some combination of both? How important was education? Was a particular type of education more important than another type? Ask the research question toward the end of the interview and ask to prioritize each element.

Mentors

Was there a mentor relationship? Was the relationship critical to a particular time in a career? Were multiple mentors a factor? Was an authority or role model figure important? Was there a love/hate issue? How did this affect career direction and timing? How does the person feel about relationships? Were the relationships strictly professional or did they also become social? Does this matter?

Personal Initiative

Did the individual have a life/career plan of how they wanted their career to progress? Did they purposefully market or sell themselves along that career plan? Why was selling necessary/not necessary? Was there soft sell or hard sell? Did the person subconsciously or consciously work on image? What was done to try to maintain control over career direction and development? How were expectations identified? How were accomplishments reported? Was this necessary? Why?

Additional Areas

Is there a effect on careers that can be correlated to time? What is that effect? How does length of experience relate to career progression? Were there trigger events that impacted career progression? How much control did individuals have over those events? What were the individual's feelings? How were negative events turned into a positive? How were positive events exploited? How did organizational or individual actions or behavioral patterns impact careers? What were the feelings of the individuals at key transition, trigger or decision points? What obstacles were identified? How were these handled? Why was it important to handle them in this particular way? How were failures handled? What are points of important/key organizational interaction? Does time play a role? How do trigger events interact? Was there an interaction between life/family goals and career goals? How did this affect actions? Were family and career interactions positive/negative? What contribution did some keys have to success (education, individuals, serendipity)? What role did personal or corporate values play in career progression?

Have you ever failed in any part of your own career? What did you do to recover? Did you see others (subordinates, peers, superiors) fail? Where did they fail? What lessons did you learn and apply to your own career?

APPENDIX B

Ranking Responses

Ranking Responses

Direct comments of research subjects regarding ranking

In the segments that follow "Q:" indicates a question or summary comment from the researcher and "MS x:" is the response.

Management Subject (MS) 1:

"Oh, experience has always been the best teacher."

"I don't want to dodge your question, but I guess I have to ... maybe it's my engineering tendencies, I have to kind of compartmentalize that. My engineering role versus my more management roles or interpersonal roles. The harder analytical roles versus the softer roles that I've played. Uh, Oddly enough to me it seems kind of different, my analytical roles, my engineering roles, my practical applications that I deal with in my job or my career, I think have been much more governed by this side over here. The on-the-job, experiences or historical experiences or less formal exposure things. Seeing things. Seeing how things work. Getting into situations, problem solving situations. Uh, the softer side issues. communications, personal dealings, speaking, talking to a group, those are greatly influenced by the education that I had, the formal education that I had."

"Oh, I'd say career development... the experience has probably been the most important to career development. The second most important I'd say the formal education. Yeah, that I would have to give mentoring the third position and the non-formal would be the last."

MS 2:

Original response was: "...so mentoring (informal), non-formal, uh, experience and formal."

Balance of interview supported experience being much higher with over 70% of identified learning being from experience.

As part of negotiated outcomes subject wrote back with response: "Since our last conversation.... I now realize that performing (experience) ...carries.. greater weight." [had to delete reference to company to maintain anonymity]

MS 3:

"To me the formal education was the ticket. Just allowed me to be considered for the other things. The most important part of my education I think would be the on-the-job, day-to-day, interaction with other people, learning as I go. I've never had a course in accounting. Not even in high school did I have a course in accounting. But I know more about accounting than I ever thought I ever wanted to know. Or finance. Or marketing. Or whatever. And you learned those as you mentioned by the experiencing end results. Some actions. Or by mentoring. Or by the process of making decisions on a day-to-day basis and seeing what the outcome of those decisions are. That to me is education. Not formal. But learn from your mistakes for crying out loud. It's not

... if you go this direction and it's not working, be willing to admit that fairly early on and change the direction a little bit. I don't see any problem with that. I don't see any problem with that for me personally. Or I don't see any problem with that for the people that work for me. The important thing is that they recognize the situation and are willing to deal with it."

".. mentor is ... important part of the process. I talk to my people all the time about mentoring the young kids."

"but to go out and do something [non-]formally, like take a [seminar] course at the AMA or something like that, I never did do that. The biggest thing those did for me was when I'd go out and set in a group of 30 people, listen to what they talked about, I found out I wasn't so bad after all."

MS 4.

Q: Talk to me about the experiential... impact on your career development.

MS 4: OK, uh, that's a large part of probably why I am where I am. ... you learn all of those things on your own. ... I would say a large part of what I'm doing now is through experience....Experiential. Yeah.....

{different segment}

Q: Now, you put mentoring and experiential at the top.

MS 4: Right... Highest importance to me I believe in where I am now.

Q: What do you see the relative importance of the formal?

MS 4: Probably the discipline of it, learning how to learn.

Q: And how about the seminar?

MS 4: For the most part I have never found seminars to be very valuable. ... I just have never found those to be .. valuable to me.

MS 5:

"I had some work experience learning while I was getting a formal education."

"Uh, I wouldn't say that it was totally experience, but probably mostly."

"..had mentors throughout.. career"

"I think it (formal education) is a foundation"

"last would be the seminar (non-formal) type of stuff"

MS 6.

"it became clear that experience ... was worth about half an MBA"

"experience is about 70% and education is about 30%" (split the two ends of the continuum without considering the middle)

"in the school of hard knocks, learning from experience.... probably one of the biggest things particularly for management issues."

"experience was the heavy weight in terms of what I got....formal education was the foundation.... got a fair amount of mentoring and seeing other people operate...seminars I did not invest my time in that kind of thing over the years"

MS 7.

"the boss worried that I didn't have a box checked on my experience card yet. (He) wanted to find an assignment for me that would enable me to do that so he could say (MS 7) has that experience as well."

"seminar type of thing was not very important ... I don't think they've been nearly as useful as on-the-job training, mentoring and experiential education have been.

"some advanced graduate level in a scientific or engineering profession was essential to getting into the organization (ticket). .... I'll say it wasn't a written requirement..but was expected of someone in that job."

MS 8.

"The undergraduate work...It was a ticket."

"Experiential..just over time. Q: your own education experience has been almost exclusively experiential?

MS 8: Right. Right.

Regarding seminars "they probably helped a little bit. But it was (experience) realization that came over a lot of time."

Had two mentors "gave me opportunities that I might not have gotten otherwise... he raised your sights"

MS 9.

Q: "where did you pick up your education for those skills?"

MS 9: "It was the school of hard knocks (experience)."

"I didn't go to those (seminars) until I had been a manager."

"he was always mentoring me. ...He was grooming me for (the next position)."

"I think the on-the-job stuff (experience then mentors) is infinitely more important than formal education."

MS 10.

"(My previous employer) is a great training ground..... extraordinary preparation..It was job training."

"It (formal education) is a threshold situation.... academic credentials that open doors. ..Beyond that all that I've achieved and positions that I've secured have been based on other than formal education (experience)"

"I feel a void in my life for not having a mentor throughout my career.... I've not really had that mentor relationship."

Seminars were only identified as taking place after transition with no identified value.

MS 11.

"I've had a real problem with mentors. I really haven't had any."

"Experiential is probably number one. Number two would probably be the educational experience that I had. The formal. The seminars would be last."

MS 12.

In responding to the continuum, this subject spoke for about 30 minutes. Approx. 20 minutes was toward the experiential aspects of subjects career. Researcher summarized with:

Q: "The exposure that you are talking about is almost all experiential."

MS 12: "Right."

Subject follow with almost 10 minutes of talking about the role of mentors in subject's career.

" I don't have time for anything like that (seminars). I don't even have time to read a book except when I am on an airplane."

"If I pace myself professionally and individually based on what I read or heard or saw in seminars, I would have given up a long time ago and I'd be working for somebody else."

"When it comes to academics, I think the ..more exposure you can give people earlier on, the more ability you have for them to be able to focus on what they are going to be good at."

MS 13.

"Experiential learning and that kind of thing. I think that played the biggest part. ....My (mentor) shaped me and pushed me in a trial and error self learning process. ... My formal training I think reinforced the informal, trial and error, experience method of learning. ..By the time it (seminars) helped me to put in place procedures that should have been in place long before. That (seminar) course may have been a lot better for me if I had had it at least ten years earlier."

Technical (T) 1.

Q: "What was most important?"

T 1: "I would say skills that I learned in ..engineering curriculum." "As you talked through the continuum, the importance of it is almost a horizontal line. ... If I had to grade them though I would say my early education, formal education experience because it gave me some real basic skills. (Then) the things that I got from my mentors. (Next) the things that I learned from experience. And then the internal company (seminars)."

T 2.

"Each played very importantly. ... I'm saying that there is no question that the educational (formal) aspects prepared me..... Then experience came into play there. Then, what about seminars and those types of things? some seminars are extremely advantageous. Particularly if you can find the seminars that are dealing with the subject of immediate interest.... Then mentoring was the influence for being considered for (senior level promotions)."

T 3.

"What influenced my career is almost entirely on the job experience."

"Technical education was good and provided good skills for technical progression and the first level of management."

"I took engineering (seminars) courses even after the PhD."

Q: "Did you ever have a mentor?"

T 3: "No."

T 4.

Impact to career development "the first one (formal) is not at all. The second (non-formal) is maybe 10%. Then I move to the informal on-the-job training, but under the guidance and direction of someone. Almost equal is what you call consequential (experiential) learning."

Q: "So first would be the informal and then the experiential/consequential, then the seminar non-formal type training and last of all the formal."

T 4: "Right"

T 5.

Q: "Would you rank them one to four?"

T 5: "Probably the formal. Then the experiential. ... Then the on-the-job, mentoring and then the seminars."

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