AN EXPERIMENTAL ASSESSMENT OF JOB TECHNOLOGY EFFECTS ON MANAGERIAL TRAINING AND DEVELOPMENT NEEDS

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CHAPTER I

LITERATURE REVIEW

Introduction

Over the last decade, training and development in business and industry have experienced unprecedented growth both in numbers of people involved professionally, or as participants, and in the value of financial resources devoted to this function. As a result, these factors have focused greater attention upon the usefulness of managerial training and development efforts. Early commentators, such as Fiedler (6) and Bowen (3), argued that training of managers is no substitute for experience. In a more recent article, Sparks (15) presents experimental results which suggest that "affective" training for managers be discontinued as relatively ineffective.

Pressures are building on the training and development practitioner to design management training and development experiences which will produce identifiable and positive results. An effective needs analysis must precede all other efforts. Thus, it is recommended that a productive area of inquiry could be the expansion of knowledge upon which the needs analysis process is currently based.

The purpose of this research will be to establish whether a relationship exists between (a) factors intrinsic to a managerial position and (b) apparent demands for training. Up to this point, it has generally been assumed that the individual who holds a managerial position should possess or develop a wide range of skills in order to be effective. However, organizational behavior research strongly suggests that variations in how work is processed through a managerial position will demand variations among those skills required for effective task execution. With the assistance of a recently developed instrument designed to measure job technology (9), it may be possible to establish the nature of any relationship between job technology and skill priority. In effect, this research could establish a link between organizational behavior theory and educational theory as applied by the training and development practitioner.

The purpose of the remainder of this chapter is to review literature related to both needs assessment as used in training and development and the concept of technology in organizational theory.

Training and Development Needs

As defined by Morrison (12, p. 9-1), "a training need may be described as existing any time an actual condition differs from a desired condition in the human or 'people' aspect of organ zational performance". In a similar fashion, Laird identifies a potential training need as a deficiency or discrepancy between minimal mastery and employee inventory (11, p. 46). As an equation, M -I = D, where

M = Minimum performance mastery

I = Employee performance inventory

D = Deficiency (potential training need).

Laird (11) further delineates between deficiencies in knowledge, execution, and practice. Execution deficiencies are considered to be outside the control of the individual and therefore not solvable by training, whereas knowledge and practice deficiencies are areas for potential training.

Another distinction which has been made concerns differences between training needs and the developmental needs. More broadly defined, Morrison (12) identifies a developmental need as one which deals with the total growth and effectiveness of the individual.

A general consensus appears to be that a training or development need occurs when a difference exists between what is and what should be with respect to either current employee performance or anticipated future performance.

Theoretical Assumptions

A close examination of these training and development needs concepts reveals the following basic assumptions:

1. It is assumed that some model of minimum performance mastery exists or can be formulated;
2. It is assumed that valid and reliable methods of assessing employee performance inventory exist or can be formulated.

Since developmental needs are many times related to future job demands, it is possible that any uncertainty associated with those projected demands will be reflected in an increasingly ambiguous minimum performance mastery model. By necessity, developmental needs assessments may have to rely upon more generalized criteria which, in turn, can affect the validity and reliability of subsequent measurements of employee performance inventory since both, ideally, use the same criteria.

In a similar manner, it could be recognized that as the direct outputs of higher level jobs become increasingly complex and intangible in nature, the ability to identify an ideal role model and assess the employee inventory will also increase in complexity while depending on higher order abstractions as the evaluative criteria.

Needs Analysis

Training and development needs analysis is a process of determining the existence of performance discrepancies with the objective of improving employee performance through an effectively designed and implemented training or development program. Steadham (16) conceptualizes this process in the following manner:

Pre-Assessment

a. Appraise the situation
b. Evaluate methods in light of appraisal
c. Select most appropriate method(s)

Assessment

a. Collect data
b. Analyze and feedback data to the client system
c. Revise data (as necessary) and develop a plan of response
d. Follow through (p. 58).

In a similar fashion, Watson (18) proposes a six-step needs-identification process:

1. Factors external to the job;
2. Factors intrinsic to the job including level, role, and technical features;
3. Forecast of changes in the above;
4. Priority of skills, knowledge, and attitudes related to the above;
5. Trainee assessment;
6. Identification of deficiencies (p. 48).

A significantly common element between these and other needs assessment models is a thorough understanding of the job, and in particular, those aspects of the job which are independent of the employee. In the above, Steadman (16) identifies situational analysis while Watson specifies particular aspects of the situation in steps one through four. In this regard, Watson (18) points out that some management literature strongly suggests that variations in managerial effectiveness may, in part, be due to differences in the underlying technologies, that is, differences in the way inputs are processed through to become outputs. While an individual may exercise some discretionary control over this process, a large portion of the job technology is a given situational factor to which the particular individual must adjust. Needless to say, a significant part of managerial training and development may be directed toward that end. Consequently, an examination of the relationship between technology and managerial training needs could provide valuable insights for subsequent efforts in program development, implementation, and evaluation.

Technology

The theoretical construct of technology has evolved from organizational theory. In general, technology involves the techniques and technical processes used to change inputs, such as material, knowledge, energy, and capital into outputs, such as products and services. As perceived by early theorists (19) (13) (17), an understanding of organizational technology could provide meaningful information related to variations which exist in organizational structure and behavior. Each of these authors proposed a classification scheme of technology upon which subsequent research has been based. The following is a description of the scheme proposed by Thompson (17, pp. 15-18).

1. Long-linked technology which involves a serial interdependence in production such that the execution of a given task is

sequentially dependent upon the successful completion of a previous task or tasks. A common example would be the mass production assembly line. Typically this technology involves a single product, is extremely repetitive, and attains a constant rate of production.

2. Mediating technology primarily functions to link clients or customers who are, or wish to be, interdependent. Common examples include banks which link borrowers to lenders, telephone service which links callers to receivers, and stock brokers who link investors. According to Thompson, this technology will generally utilize standardization and bureaucratic structure to manage the diversity associated with a heterogeneous clientele.

3. Intensive technology requires a variety of techniques which are drawn upon in order to achieve a change in some specific object; the selection, combination, and order of application are uniquely determined by feedback from the object. Manufacturers which deal in customized products and hospitals which respond to the unique needs of the patient are examples of intensive technologies. This technology will typically require management to organize and reorganize diverse resources in order to address constantly shifting priorities and demands.

In a very similar way, Woodward (19) defined mass production, process production, and small-batch production as distinct technologies. Perrow (13), using a definition of technology based upon the number of problems encountered and the degree to which those problems could be solved with standardized methods, identified routine, craft, engineering, and non-routine as technology categories.

Although variations exist among these classifications, the end result is to broadly distinguish among increasing levels of technological complexity.

Technology Research Findings

Some of the past research in technology have been directed toward attempts to define the relationship between technology and structure; that is, the relationship between the processes required to change inputs to outputs and the various ways firms organize themselves to facilitate the process. Although not directly addressing the training and development function, some of these findings have implications for this research. For example, research conducted by Comstock and Scott (5) indicated that both centralization of decision making and standardization of procedures increased as the work-flow became more predictable. Since the predictability of work-flow decreases from long-linked (1) technology through mediating technology to intensive technology, this could imply that the demand on managers to exhibit good decision-making skills would be more acute for the decentralized, intensive technology than for the more centralized, policy-based mediating technology, and ultimately, the predictable and repetitive long-linked technology.

Another area of inquiry which has training and development implica- (2) tions involves the relationship between technology and organizational behavior. As an example, Billings et al. (2) studied a change in technology from batch (intensive technology) to mass (long-linked technology) production in a hospital dietary department using a time-series analysis of structured interview data. They found that characteristics of the work changed with an increase in task interdependence and a decrease in job importance, task variety, required task effort, and task mobility. Implications for the manager include an increased demand to address potential employee dissatisfaction as reflected through motivation, absenteeism and turnover problems.

In another study, Rousseau (14) surveyed employees from nineteen production units and made the following conclusions regarding Thompson's technology classifications:

1. Long-linked technologies, in constrast to intensive and mediating ones, provide little opportunity to deal with others, to use a variety of skills, to make decisions, to learn, and to do work with high task significance.

2. Mediating technologies, in contrast to intensive organizations, were characterized by relatively high task identity and feedback.

3. Levels of satisfaction and motivation correspond to the variations in job dimensions' levels across technologies, with long-linked organizations having the lowest general job satisfaction and involvement and the highest alienation. Mediating technologies have the highest general job satisfaction and involvement and the lowest alienation (p. 40).

In yet another study designed to investigate the impact of technology on the relationship between work unit climate and effectiveness, Hitt found strong evidence that climates predictive of work-unit effectiveness vary with the dominant technology of the work-unit. Technology served to moderate the dimensions of climate most related to effectiveness (7). As such, it could be that any attempted behavior change which is not congruent with the given technology may not receive the support of the work-unit climate and eventually be perceived as ineffective.

These studies strongly suggest that technology has a definite effect on organizational behavior, employee behavior (motivation, absenteeism, turnover, etc.) and employee attitude (satisfaction expectancies). As described by Billings (2), the impact of technology has an effect on an individual through its effect on individual job characteristics, such as task variety, task interdependence, job complexity, autonomy, and feedback.

Conclusion

Needs analysis in training and development depends to a large extent on the ability to define an ideal model of minimum performance mastery and then to successfully measure current employee performance relative to that model. Any ambiguity introduced at this stage will cause less than perfect assessment of employee performance discrepancies. In addition, it has been suggested that as direct job outputs become more abstractly defined, the opportunity for ambiguity increases. For example, 65 words per minute with two errors is a much more concrete measure of typing output than is three decisions per hour where such decisions are subject to quantitative and qualitative review within a given situation.

In order to address this issue, it is apparent that better understanding of complex jobs is required. This involves not only an understanding of the individual but also the job demands which impact the individual and interrelationships which exist between the two. To this end, the concept of technology, defined as the process of converting inputs to outputs, has been identified. Various theorists have identified levels of technological complexity. Subsequently, researchers have identified the effects of job technolgoy on structure, behavior, and attitude. A next step would be to establish if a relationship exists between job technology and particular skills required for minimum performance mastery. In the case of managerial positions which typically exhibit various degrees of technological complexity, if it can be shown that these variations correspond to variations in required managerial skills, it would be possible to

1. Define managerial positions in terms of those skills required by the measured technology.
2. Concentrate training efforts for a particular manager on those skills identified by the particular job technology.
3. Design career development opportunities based upon skills defined by the current technology of potential future positions.

The training and development of managers in particular has been increasingly subjected to critical examination with various claims on its effectiveness or lack of such. Since needs determination provides the key criterion elements upon which the success of subsequent training and development efforts must depend, expansion of knowledge concerning this process may be one means of addressing such criticism. This research will provide the framework for the synthesis of two areas of inquiry, organizational behavior theory and educational theory as applied by training and development practitioners.

CHAPTER II

STATEMENT OF HYPOTHESIS AND EXPERIMENTAL METHODOLOGY

The purpose of this chapter is to formalize an experimental hypothesis and to discuss the design, implementation and statistical procedure used for an analysis of results.

Statement of Hypothesis

This research is intended to demonstrate that significant relationships exist between levels of complexity in managerial job technology and the level of importance assigned to various managerial skills required to achieve effective performance. Since a variety of managerial skills are involved, each will be tested independently against job technology. As variations occur in technological complexity, variations should occur with respect to the importance assigned to each skill. The resulting analysis should identify particular skills which are critical to effective job performance for various levels of technological complexity. The null hypothesis for this analysis would imply that variations in level of job technology will not exhibit a significant causal relationship to variations in the level of importance assigned to managerial skills required to achieve effective performance.

Theoretically, the nature of the relationships which should emerge may vary from one managerial skill to another. Most past research has assumed that a positive or negative linear relationship existed between technology and the dependent variable being analyzed. However, a more recent report by Hitt, Hromas, and Womack (8) found that, in the case of technology and job satisfaction, a non-linear, parabolic relationship emerged. This research required the classification of technological complexity into low, medium, and high levels with independent analysis for each pairing against measures of job satisfaction.

Experimental Methodology

This section will discuss the design and implementation aspects of this research which are intended to generate numerical data for statistical analysis and hypothesis testing.

Experimental Design

The experiment has been designed to measure the complexity of individual job technology and the importance assigned to various managerial skills in achieving effective performance. Since the relationship between each skill and technology will by analyzed separately, a series of one-on-one experiments will result with technology as the main effect (independent variable) and managerial skill importance representing the dependent variable.

Each experimental subject will be asked to fill out a questionnaire having two sections. One section will measure the complexity of that individual's job technology. The other section will list a variety of managerial skills and ask the respondent to indicate the level of importance associated with each skill in achieving effective performance in their particular job. The purpose of each section will be to generate numerical data for technological classification and subsequent statistical analysis and hypothesis testing.

Sampling Procedure

The questionnaire was administered to 72 Oklahoma State University professional supervisors and mid-managers during their participation in a 15-hour supervisory skills development short course. This research was conducted in cooperation with the Oklahoma State University Staff Development Committee in response to their need for information pertinent to the planning and development of future training programs and activities.

Data Collection

The questionnaire designed for this experiment will appear in many respects to be similar to a managerial needs analysis survey with the addition of a unique section designed to measure the technological complexity of the respondent's current job.

Section One of this questionnaire will present 36 skills as identified by Braun (4) in his article, "Assessing Supervisory Training Needs and Evaluating Effectiveness". Each respondent will be asked to rate on a five-point scale the relative importance of each skill in achieving effective performance in their jobs. This section will also contain a five-point scale for each skill soliciting the level of desire for additional information. Although not directly related to this experiment, this information will provide valuable input for the planning and development of future programs and activities.

Section Two of the questionaire will measure individual job technology using an instrument developed and refined by Hitt and Middlemist (9). This instrument, successfully applied and verified in previous research, asks a variety of job-related questions. Responses are numerically identified resulting in an overall measure of technological complexity for the respondent's particular job. A copy of the questionnaire has been included in Appendix A.

Experimental Variables

Measures of technological complexity will serve as the independent variable for analysis while measures of managerial skill importance will be used in a series of tests, each dependent upon technology. Operationally, these variables are defined by their respective sections of the experimental questionnaire.

Statistical Procedure

A simple analysis of variance was employed to test for a significant relationship between technological complexity and skill importance. Since the sample will be split into three groups according to level of technological complexity, three F-ratios were calculated for each managerial skill. In effect, this procedure will analyze the distribution of responses to the managerial skill importance questions for each of the three levels of technological complexity and compare all pairings for significant differences. This procedure was repeated for each of the 36 managerial skills identified.

CHAPTER III

ANALYSIS OF EXPERIMENTAL RESULTS

This chapter will discuss the statistical analysis used for the experiment, present the results of analysis and summarize those results.

Statistical Procedure

The statistical analysis applied to this experiment was analysis of variance utilizing the GLM procedure developed for the Statistical Analysis System Institute Incorporated by Barr et al. (1). Among other things, this procedure was designed to adjust for unequal numbers of observations across cells and the use of classified independent variables.

This procedure was used to analyze for differences in responses to the skill importance items due to differences among three levels of technological complexity. The sample was split into three groups due to prior evidence which indicated the potential for some non-linear relationships to emerge. As a result, an analysis of variance was applied to each skill three times representing the three possible pairings among the levels of technological complexity. This, in turn, generated 108 F-ratios for each comparison, each with an associated level of significance.

Analysis of Results

The following 36 tables represent the statistical analysis for each of the 36 skills identified in the experimental questionnaire. The experimental sample was split into three groups according to level of technological complexity. For each skill, comparisons were made between the low and medium levels, and between the medium and high levels, and between the low and high levels. The mean response for each group is recorded in the cell under the appropriate heading. A significance level (P > F) greater than .05 was deemed insignificant and so designated by the symbol "NS."

TABLE I

ANALYSIS OF VARIANCE BETWEEN ABILITY TO SET OBJECTIVES AND DEVELOP PROJECTS (P1) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	3.26	4.31		9.17	.01
Medium/High		4.31	3.93	1.39	NS
Low/High	3.26		3.93	3.42	NS

TABLE II

ANALYSIS OF VARIANCE BETWEEN ABILITY TO DEVELOP PLANS (P2) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	3.47	4.10		2.25	NS
Medium/High		4.10	3.76	.90	NS
Low/High	3.47		3.76	.37	NS

TABLE III

ANALYSIS OF VARIANCE BETWEEN ABILITY TO SET PRIORITIES ON WORK (P3) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	4.47	4.57		.09	NS
Medium/High		4.57	4.36	.65	NS
Low/High	4.47		4.36	.21	NS

TABLE IV

ANALYSIS OF VARIANCE BETWEEN ABILITY TO BUDGET (P4) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	2.63	3.73		6.26	.01
Medium/High		3.73	3.20	2.54	NS
Low/High	2.63		3.20	1.58	NS

TABLE V

ANALYSIS OF VARIANCE BETWEEN ABILITY TO USE TIME EFFECTIVELY (P5) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	4.57	4.57		.01	NS
Medium/High		4.57	4.63	.03	NS
Low/High	4.57		4.63	.06	NS

TABLE VI

ANALYSIS OF VARIANCE BETWEEN ABILITY TO ASSIGN WORK TO PEOPLE (D1) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	4.21	4.26		.00	NS
Medium/High		4.26	4.20	.00	NS
Low/High	4.21		4.20	.01	NS

TABLE VII

ANALYSIS OF VARIANCE BETWEEN ABILITY TO DELEGATE (D2) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	4.30	4.47		.09	NS
Medium/High		4.47	4.20	.91	NS
Low/High	4.30		4.20	.28	NS

TABLE VIII

ANALYSIS OF VARIANCE BETWEEN ABILITY TO MOTIVATE PEOPLE (D3) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

Pairing	Table of Means for Three Levels of Technological Complexity			F-Ratio	P > F
	Low N = 20	Medium N = 21	High N = 31		
Low/Medium	4.26	4.52		.60	NS
Medium/High		4.52	4.20	1.19	NS
Low/High	4.26		4.20	.05	NS

TABLE IX

ANALYSIS OF VARIANCE BETWEEN ABILITY TO UNDERSTAND PEOPLE OF DIFFERENT AGES, RACES, BACKGROUNDS, ETC. (D4) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

Pairing	Table of Means for Three Levels of Technological Complexity			F-Ratio	P > F
	Low N = 20	Medium N = 21	High N = 31		
Low/Medium	3.15	3.84		2.04	NS
Medium/High		3.84	3.60	.43	NS
Low/High	3.15		3.60	1.21	NS

TABLE X

ANALYSIS OF VARIANCE BETWEEN ABILITY TO RECOGNIZE AND ANALYZE PROBLEMS (PS1) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

Pairing	Table of Means for Three Levels of Technological Complexity Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	4.26	4.26		.04	NS
Medium/High		4.26	4.40	.88	NS
Low/High	4.26		4.40	.27	NS

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ANALYSIS OF VARIANCE BETWEEN ABILITY TO IDENTIFY SOLUTIONS TO PROBLEMS (PS2) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

Pairing	Table of Means for Three Levels of Technological Complexity Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	4.15	4.57		2.33	NS
Medium/High		4.47	4.43	1.22	NS
Low/High	4.15		4.43	.88	NS

TABLE XII

ANALYSIS OF VARIANCE BETWEEN ABILITY TO DECIDE WHICH SOLUTION IS BEST (PS3) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

Pairing	Table of Means for Three Levels of Technological Complexity			F-Ratio	P > F
	Low N = 20	Medium N = 21	High N = 31		
Low/Medium	4.00	4.42		1.68	NS
Medium/High		4.42	4.33	.13	NS
Low/High	4.00		4.33	1.32	NS

TABLE XIII

ANALYSIS OF VARIANCE BETWEEN ABILITY TO MAKE DECISIONS IN EMERGENCIES (PS4) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

Pairing	Table of Means for Three Levels of Technological Complexity			F-Ratio	P > F
	Low N = 20	Medium N = 21	High N = 31		
Low/Medium	3.52	4.57		8.21	.01
Medium/High		4.57	4.36	.58	NS
Low/High	3.52		4.36	5.75	.02

TABLE XIV

ANALYSIS OF VARIANCE BETWEEN ABILITY TO INFORM SUPERIOR (C1) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	4.31	4.63		1.65	NS
Medium/High		4.63	4.30	2.47	NS
Low/High	4.31		4.30	.07	NS

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ANALYSIS OF VARIANCE BETWEEN ABILITY TO INFORM SUBORDINATES (C2) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	3.94	4.52		2.10	NS
Medium/High		4.52	4.06	1.80	NS
Low/High	3.94		4.06	.07	NS

TABLE XVI

ANALYSIS OF VARIANCE BETWEEN ABILITY TO ANSWER QUESTIONS ON PERSONNEL PRACTICES (C3) AND LEVELS OF TECHNOLOGICAL COMPLEXITY

Pairing	Table of Means for Three Levels of Technological Complexity			F-Ratio	P > F
	Low N = 20	Medium N = 21	High N = 31		
Low/Medium	2.89	4.00		5.41	.02
Medium/High		4.00	2.76	11.09	.01
Low/High	2.89		2.76	.32	NS

TABLE XVII

ANALYSIS OF VARIANCE BETWEEN ABILITY TO CONDUCT FORMAL BRIEFINGS (C4) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

Pairing	Table of Means for Three Levels of Technological Complexity			F-Ratio	P > F
	Low N = 20	Medium N = 21	High N = 31		
Low/Medium	2.10	3.52		14.95	.01
Medium/High		3.52	2.53	9.17	.01
Low/High	2.10		2.53	1.60	NS

TABLE XVIII

ANALYSIS OF VARIANCE BETWEEN ABILITY TO LEAD
MEETINGS (C5) AND THREE LEVELS
TECHNOLOGICAL COMPLEXITY

Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
	Table of Means for Three Levels of Technological Complexity				
Low/Medium	2.15	3.63		11.94	.01
Medium/High		3.63	3.16	1.74	NS
Low/High	2.15		3.16	4.31	.04

TABLE XIX

ANALYSIS OF VARIANCE BETWEEN ABILITY TO LEARN AND
ACCEPT VIEW OF OTHERS (C6) AND THREE LEVELS
OF TECHNOLOGICAL COMPLEXITY

Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
	Table of Means for Three Levels of Technological Complexity				
Low/Medium	3.78	4.42		3.97	.05
Medium/High		4.42	4.20	.84	NS
Low/High	3.78		4.20	2.00	NS

TABLE XX

ANALYSIS OF VARIANCE BETWEEN ABILITY TO RELATE NEGATIVE INFORMATION (C7) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	3.15	3.89		3.69	NS
Medium/High		3.89	4.00	.28	NS
Low/High	3.15		4.00	6.91	.01

TABLE XXI

ANALYSIS OF VARIANCE BETWEEN ABILITY TO COMPLETE REPORTS AND FORMS (C8) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	3.42	4.31		3.70	NS
Medium/High		4.31	4.33	.03	NS
Low/High	3.42		4.33	5.36	.02

TABLE XXII

ANALYSIS OF VARIANCE BETWEEN ABILITY TO WRITE FORMAL LETTERS (C9) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	3.00	3.94		3.09	NS
Medium/High		3.94	3.96	.01	NS
Low/High	3.00		3.96	4.06	.04

TABLE XXIII

ANALYSIS OF VARIANCE BETWEEN ABILITY TO DETERMINE WHAT TRAINING PEOPLE SHOULD HAVE (T1) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	3.52	4.10		1.59	NS
Medium/High		4.10	3.56	1.18	NS
Low/High	3.52		3.56	.09	NS

TABLE XXIV

ANALYSIS OF VARIANCE BETWEEN ABILITY TO CONDUCT ON-THE-JOB TRAINING (T2) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	4.31	4.47		.01	NS
Medium/High		4.47	3.86	2.61	NS
Low/High	4.31		3.86	1.80	NS

TABLE XXV

ANALYSIS OF VARIANCE BETWEEN ABILITY TO DEVELOP MATERIAL FOR FORMAL CLASSROOM TRAINING (T3) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	1.42	2.63		9.99	.01
Medium/High		2.63	2.23	1.30	NS
Low/High	1.42		2.23	6.78	.01

TABLE XXVI

ANALYSIS OF VARIANCE BETWEEN ABILITY TO CONDUCT FORMAL CLASSROOM TRAINING (T4) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	1.36	2.68		12.94	.01
Medium/High		2.68	2.20	1.78	NS
Low/High	1.36		2.20	6.59	.01

TABLE XXVII

ANALYSIS OF VARIANCE BETWEEN ABILITY TO EVALUATE THE EFFECT OF TRAINING (T5) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	3.05	3.42		.42	NS
Medium/High		3.42	3.30	.16	NS
Low/High	3.05		3.30	.13	NS

TABLE XXVIII

ANALYSIS OF VARIANCE BETWEEN ABILITY TO INTERVIEW JOB CANDIDATES (H1) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

Pairing	Table of Means for Three Levels of Technological Complexity			F-Ratio	P > F
	Low N = 20	Medium N = 21	High N = 31		
Low/Medium	3.42	3.89		.43	NS
Medium/High		3.89	3.80	.01	NS
Low/High	3.42		3.80	.60	NS

TABLE XXIX

ANALYSIS OF VARIANCE BETWEEN ABILITY TO SELECT PEOPLE FOR JOBS (H2) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

Pairing	Table of Means for Three Levels of Technological Complexity			F-Ratio	P > F
	Low N = 20	Medium N = 21	High N = 31		
Low/Medium	3.21	4.21		3.60	NS
Medium/High		4.21	3.93	.25	NS
Low/High	3.21		3.93	2.53	NS

TABLE XXX

ANALYSIS OF VARIANCE BETWEEN ABILITY TO DEVELOP WORK STANDARDS (PR1) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

Pairing	Table of Means for Three Levels of Technological Complexity			F-Ratio	P > F
	Low N = 20	Medium N = 21	High N = 31		
Low/Medium	4.00	4.36		1.11	NS
Medium/High		4.36	3.63	5.05	.02
Low/High	4.00		3.63	1.19	NS

TABLE XXXI

ANALYSIS OF VARIANCE BETWEEN ABILITY TO MEASURE PEOPLE (PR2) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

Pairing	Table of Means for Three Levels of Technological Complexity			F-Ratio	P > F
	Low N = 20	Medium N = 21	High N = 31		
Low/Medium	3.84	4.36		2.46	NS
Medium/High		4.36	3.66	7.09	.01
Low/High	3.84		3.66	.60	NS

TABLE XXXII

ANALYSIS OF VARIANCE BETWEEN ABILITY TO CONDUCT APPRAISAL DISCUSSION (PR3) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	3.57	4.15		.90	NS
Medium/High		4.15	3.56	1.72	NS
Low/High	3.57		3.56	.03	NS

TABLE XXXIII

ANALYSIS OF VARIANCE BETWEEN ABILITY TO DEVELOP INDIVIDUAL DEVELOPMENT PLANS (PR4) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	2.36	3.47		8.46	.01
Medium/High		3.47	3.00	1.08	NS
Low/High	2.36		3.00	3.11	NS

TABLE XXXIV

ANALYSIS OF VARIANCE BETWEEN ABILITY TO RECOMMEND REWARDS (PR5) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

Pairing	Table of Means for Three Levels of Technological Complexity			F-Ratio	P > F
	Low N = 20	Medium N = 21	High N = 31		
Low/Medium	2.36	3.10		1.93	NS
Medium/High		3.10	2.53	2.29	NS
Low/High	2.36		2.53	.00	NS

TABLE XXXV

ANALYSIS OF VARIANCE BETWEEN ABILITY TO RECOMMEND DISCIPLINE (PR6) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

Pairing	Table of Means for Three Levels of Technological Complexity			F-Ratio	P > F
	Low N = 20	Medium N = 21	High N = 31		
Low/Medium	3.15	4.10		4.52	.03
Medium/High		4.10	3.10	6.84	.01
Low/High	3.15		3.10	.15	NS

TABLE XXXVI

ANALYSIS OF VARIANCE BETWEEN ABILITY TO COUNSEL PEOPLE WITH DISCIPLINE PROBLEMS (PR7) AND THREE LEVELS OF TECHNOLOGICAL COMPLEXITY

	Table of Means for Three Levels of Technological Complexity				
Pairing	Low N = 20	Medium N = 21	High N = 31	F-Ratio	P > F
Low/Medium	3.42	4.21		2.33	NS
Medium/High		4.21	3.30	3.62	NS
Low/High	3.42		3.30	.12	NS

Summary of Analysis of Variance

Thirty-six managerial skills were analyzed for differences in perceived importance to one's job across three levels of technological complexity. These results indicate that the level of importance associated with sixteen of those skills is significantly related to the level of tehnological complexity associated with the job. These findings reflect the following cases.

As a first case, the findings for three skills strongly suggest a parabolic relationship where those in the medium technological complexity level responded with significantly higher importance ratings than both the low and high technological complexity levels. These three skills include: ability to answer questions on personnel practices;

ability to conduct formal briefings; ability to recommend discipline. In all three skills, no significant relationship was found between the low and high groups. As a matter of interpretation, these results would strongly suggest that the ability to perform these skills is significantly more important to mediating technology managers than those in either a long-linked or intensive technology position.

A second case of nonlinear relationships reflects a significant difference between the low technological complexity level and both the medium and high technological comlexity levels where no significant difference was found between the medium and high technological levels. Four skills involved were: ability to make decisions in emergencies; ability to lead meetings; ability to develop material for formal classroom training; ability to conduct formal classroom training. This evidence strongly suggests that, for both mediating and intensive technology jobs, these skills are significantly more important than the importance identified by technology managers.

A third case of nonlinearity involves a significant difference between low technological complexity and medium technological complexity levels without any significant relationship shown with the high technological complexity level. These four skills included: ability to set objectives or develop projects; ability to budget; ability to listen and accept views of others; ability to develop individual development plans. Similar to the prior case, these results strongly suggest that these skills are significantly more important to a mediating technology manager than to a long-linked technology manager. However, the evidence is not strong enough to make this distinction with respect to those in intensive technology positions. In effect, it is not clear whether a parabolic or increasing at a decreasing rate type relationship exists across all three levels of technological complexity.

A fourth case of nonlinearity reflects a mirror image of the previous case. In these findings, a significant relationship was established between the medium technological complexity level and the high technological complexity level without any significant findings related to the low technological complexity level. These skills included two from the performance review section: ability to develop work standards; ability to measure people. These results strongly suggest that these skills are significantly more important to a mediating technology manager than to an intensive technology manager. However, the evidence is not strong enough to identify whether the relationship is parabolic or decreasing at an increasing rate across all three levels of technological complexity.

A final case identifies a significant relationship found between the low technological complexity level and the high technological complexity level. However, no other significant relationships were indicated. Three communication skills involved were: ability to relate negative information; ability to complete reports and forms; ability to write formal letters. These findings strongly suggest that skill importance increases across levels of technological complexity with significant differences occurring only between the extremes, long-linked and intensive technologies.

A graphical representation of these significant relationships is presented in Appendix B. Table XXXVII summarizes these results.

TABLE XXXVII

SUMMARY OF SIGNIFICANT RESULTS FOR ANALYSIS OF VARIANCE

SKILL	REMARKS
1. Ability to answer questions on personnel practices (C3) 2. Ability to conduct formal briefings (C4) 3. Ability to recommend discipline (PR6)	Medium technological complexity level was significantly higher than both the low level and high level
1. Ability to make decisions in emergencies (PS4) 2. Ability to lead meetings (C5) 3. Ability to develop material for formal classroom training (T3) 4. Ability to conduct formal classroom training (T4)	Low technological complexity level was significanty lower than both the medium and high levels
1. Ability to set objectives or develop projects (P1) 2. Ability to budget (P4) 3. Ability to list and accept views of others (C6) 4. Ability to develop individual development plans (PR4)	Low technological complexity level was significantly lower than the medium level; no significant findings involving the high level
1. Ability to develop work standards (PR1) 2. Ability to measure people (PR2)	High technological complexity level significantly lower than medium level; no significant findings involving the low level
1. Ability to relate negative information (C7) 2. Ability to complete reports and forms (C8) 3. Ability to write formal letters (C9)	Low technological complexity level significantly lower than the high level; no significant findings involving the medium level

Comparison of Rank Order

To provide a practical frame of reference from which the relative importance between these skills can be examined, the following two tables have been tabulated from the mean responses obtained for each skill within levels of technological complexity. Table XXXVIII, "Rank Order of Skill Importance by Level of Technological Complexity", ranks the skills in descending order of relative importance for each complexity level. Table XXXIX, "Comparative Skills Rank by Level of Technological Complexity", rearranged this information according to relative overall rank with a category for significant skills, as previously identified, and common skills. With reference to Table XXXIX, the common skills, listed in descending order of relative overall importance, represent a cluster of common core skills unrelated to job technology. Within the significant skills category, seven of the potential nine skills comprising the lowest quartile of overall importance are identified. Although significant differences were found for these skills, they should be considered as part of the common core since any elaboration on the significant differences among relatively unimportant skills has little practical application.

Factor Analysis

As an attempt to identify additional skill clusters, particularly those unique to level of technological complexity, an independent factor analysis was run for each level. This analysis generated nine significant factors for each level. The following tables represent a factor-by-factor comparison across levels of technological complexity. Insignificant factor loadings were deleted from the tables, as well as

TABLE XXXVIII

RANK ORDER OF SKILL IMPORTANCE BY LEVEL OF TECHNOLOGICAL COMPLEXITY

Level of Technological Complexity								
Low			Medium			High		
Rank	Skill	Mean	Rank	Skill	Mean	Rank	Skill	Mean
1	P5	4.57	1	C1	4.63	1	P5	4.63
2	P3	4.47	3.5	P3	4.57	2	PS2	4.43
4	D2	4.31	3.5	P5	4.57	3	PS1	4.40
4	C1	4.31	3.5	PS2	4.57	4.5	P3	4.36
4	T2	4.31	3.5	PS4	4.57	4.5	PS4	4.36
6.5	D3	4.26	6.5	D3	4.52	6.5	PS3	4.33
6.5	PS1	4.26	6.5	C2	4.52	6.5	C8	4.33
8	D1	4.21	8.5	D2	4.47	8	C1	4.30
9	PS2	4.15	8.5	T2	4.47	10.5	D1	4.20
10.5	PS3	4.00	10.5	P53	4.42	10.5	D2	4.20
10.5	PR1	4.00	10.5	C6	4.42	10.5	D3	4.20
12	C2	3.94	12.5	PR2	4.36	10.5	C6	4.20
13	PR2	3.84	12.5	PR1	4.36	13	C2	4.06
14	C6	2.78	14.5	C8	4.31	14	C7	4.00
15	PR3	3.57	14.5	P1	4.31	15	C9	3.96
16.5	T1	3.52	16.5	D1	4.26	16.5	P1	3.93
16.5	PS4	3.52	16.5	PS1	4.26	16.5	H2	3.93
18	P2	3.47	18.5	PR7	4.21	18	T2	3.86
20	C8	3.42	18.5	H2	4.21	19	H1	3.80
20	PR7	3.42	20	PR3	4.15	20	P2	3.76
20	H1	3.42	22	P2	4.10	21	PR2	3.66
22	P1	3.26	22	T1	4.10	22	PR1	3.63
23	H2	3.21	22	PR6	4.10	23	D4	3.60
25	PR6	3.15	24	C3	4.00	24.5	T1	3.56
25	D4	3.15	25	C9	3.94	24.5	PR3	3.56
25	C7	3.15	26.5	H1	3.89	26.5	T5	3.30
27	T5	3.05	26.5	C7	3.89	26.5	PR7	3.30
28	C9	3.00	28	D4	3.84	28	P4	3.20
29	C3	2.89	29	P4	3.73	29	C5	3.16
30	P4	2.63	30	C5	3.63	30	PR6	3.10
31.5	PR4	2.36	31	C4	3.52	31	PR4	3.00
31.5	PR5	2.36	32	PR4	3.47	32	C3	2.76
33	C5	2.15	33	T5	3.42	33.5	C4	2.53
34	C4	2.10	34	PR5	3.10	33.5	PR5	2.53
35	T3	1.42	35	T4	2.68	35	T3	2.23
36	T4	1.36	36	T3	2.63	36	T4	2.20

TABLE XXXIX

COMPARATIVE SKILL RANK BY LEVEL OF TECHNOLOGICAL COMPLEXITY

Common Skills	Level of Technological Complexity: Low	Medium	High	Average Rank	Overall Rank
P5	1	3.5	1	1.8	1
P3	2	3.5	4.5	3.3	2
C1	4	1	8	4.3	3
PS2	9	3.5	2	4.8	4
D2	4	8.5	10.5	7.6	5
D3	6.5	6.5	10.5	7.8	6
PS1	6.5	16.5	3	8.6	8
PS3	10.5	10.5	6.5	9.1	9
T2	4	8.5	18	10.1	10
C2	12	6.5	13	10.5	11
D1	8	16.5	10.5	11.6	12.5
H2	23	18.5	16.5	19.3	18
PR3	15	20	24.5	19.8	19
P2	18	22	20	20	20
T1	16.5	22	24.5	21	21
PR7	20	18.5	26.5	21.6	22
H1	20	26.5	19	21.8	23.5
D4	25	28	23	25.3	26
T5	27	33	26.5	28.8	29
PR5	31.5	34	33.5	33	34
Significant Skills					
PS4	16.5	3.5	4.5	8.1	7
C6	14	10.5	10.5	11.6	12.5
C8	20	14.5	6.5	13.6	14
PR1	10.5	12.5	22	15	15
PR2	13	12.5	21	15.5	16
P1	22	14.5	16.5	17.6	17
C7	25	26.5	14	21.8	23.5
C9	28	25	15	22.6	25
PR6	25	22	30	25.6	27
C3	29	24	32	28.3	28
P4	30	29	28	29	30
C5	33	30	29	30.6	31
PR4	31.5	32	31	31.5	32
C4	34	31	33.5	32.8	33
T3	35	36	35	35.5	35
T4	36	35	36	35.6	36

Factor 9, which identified no significant loadings for any of the three levels.

From Table XL, which has compared Factor 1 across levels of technological complexity, a cluster of common core skills appears to emerge with 19 of the 27 common skills identified through significant loadings in at least two levels. In addition, the following factors appear to cluster specific skills within each level.

1. Factor 2:
   - A. Contains a general communication cluster for the high technological complexity level directed toward meetings with superiors and subordinates concerning planning and motivation.
   - B. Contains a problem-solving cluster for the medium complexity level concerned with an understanding and resolution of subordinate discipline problems.
   - C. Contains a communication cluster for the low complexity level concerned with oral presentations in briefings, meetings, and training sessions.
2. Factor 3:
   - A. Contains a general problem-solving cluster for the high technological complexity level directed toward the completion of reports and forms.
   - B. Contains a cluster of skills for the low technological complexity level concerning budgeting with particular application to subordinate development and recommended awards.

TABLE XL

COMPARISON AMONG THREE LEVELS OF
TECHNOLOGICAL COMPLEXITY
FOR FACTOR 1

Factor Loading Technological Level			
Skill	Low	Medium	High
P1		.56	.67
P2	.63	.53	
P3	.82	.53	.60
P4			.55
P5	.72	.56	
D1	.90	.58	.66
D2	.91	.73	.61
D3	.87	.72	
D4			.52
PS1	.71	.70	
PS2	.86		
PS3	.91	.64	
PS4	.65	.63	
C1		.51	
C2	.83	.66	.61
C3	.52	.59	
C4		.52	
C5		.71	
C6	.73	.55	
C7	.85	.79	
C8			
C9			
T1	.73	.68	.73
T2	.55		.76
T3		.50	
T4			
T5	.55	.70	.57
H1	.69	.50	.77
H2	.65	.67	.75
PR1	.87	.52	.82
PR2	.88	.66	.86
PR3	.70	.67	.89
PR4	.63	.60	
PR5	.56	.69	.58
PR6	.83	.57	.82
PR7	.86		.86

TABLE XLI

COMPARISON AMONG THREE LEVELS
OF TECHNOLOGICAL COMPLEXITY
FOR FACTOR 2

Factor Loading Technological Level			
Skill	Low	Medium	High
P1		.53	
P2			.59
P3			
P4			
P5			
D1			.50
D2			
D3			.55
D4		.59	
PS1			
PS2		.63	
PS3		.64	
PS4		.52	
C1			.70
C2			.63
C3			
C4	.80		
C5	.73		.58
C6			
C7			
C8	.56		
C9	.56		
T1			
T2			
T3	.67		.52
T4	.62		.52
T5			.51
H1		.53	
H2			
PR1			
PR2			
PR3			
PR4			.51
PR5			
PR6		.50	
PR7		.57	

TABLE XLII

COMPARISON AMONG THREE LEVELS
OF TECHNOLOGICAL COMPLEXITY
FOR FACTOR 3

Factor Loading Technological Level			
Skill	Low	Medium	High
P1			
P2			
P3			
P4	.81		
P5			
D1			
D2			
D3			
D4			
PS1			.88
PS2			.84
PS3			.77
PS4			
C1			
C2			
C3			
C4			
C5			
C6			
C7			
C8			.58
C9			
T1			
T2			
T3			
T4		.64	
T5			
H1			
H2			
PR1			
PR2			
PR3			
PR4	.67		
PR5	.69		
PR6			
PR7			

TABLE XLIII

COMPARISON AMONG THREE LEVELS OF TECHNOLOGICAL COMPLEXITY FOR FACTOR 4

Factor Loading Technological Level			
Skill	Low	Medium	High
P1			
P2			
P3			
P4			
P5			
D1			
D2			
D3			
D4			
PS1			
PS2			
PS3			
PS4			
C1	.58	.59	
C2			
C3			.60
C4			
C5			
C6			.67
C7			
C8		.64	
C9			
T1			
T2			
T3	.53		
T4	.62		
T5			
H1			
H2			
PR1			
PR2			
PR3			
PR4			
PR5			.50
PR6			
PR7			

TABLE XLIV

COMPARISON AMONG THREE LEVELS
OF TECHNOLOGICAL COMPLEXITY
FOR FACTOR 5

Factor Loading Technological Level			
Skill	Low	Medium	High
P1	.61		
P2			
P3			
P4			
P5			
D1			
D2			
D3			
D4			
PS1			
PS2			
PS3			
PS4			
C1			
C2			
C3			
C4			.64
C5			
C6			
C7			
C8			
C9			
T1			
T2			
T3			
T4			
T5			
H1			
H2			
PR1			
PR2			
PR3			
PR4			
PR5			
PR6			
PR7			

TABLE XLV

COMPARISON AMONG THREE LEVELS
OF TECHNOLOGICAL COMPLEXITY
FOR FACTOR 6

Factor Loading Technological Level			
Skill	Low	Medium	High
P1			
P2			
P3			
P4			
P5			
D1			
D2			
D3			
D4			
PS1			
PS2			
PS3			
PS4			
C1			
C2			
C3			
C4			
C5			
C6			
C7			
C8			
C9			.64
T1			
T2			
T3			
T4			
T5			
H1			
H2			
PR1			
PR2			
PR3			
PR4			
PR5			
PR6			
PR7			

TABLE XLVI

COMPARISON AMONG THREE LEVELS OF TECHNOLOGICAL COMPLEXITY FOR FACTOR 7

Factor Loading Technological Level			
Skill	Low	Medium	High
P1			
P2			
P3			
P4		.67	
P5			
D1			
D2			
D3			
D4			
PS1			
PS2			
PS3			
PS4			
C1			
C2			
C3			
C4			
C5			
C6			
C7			
C8			
C9			
T1			
T2			
T3			.53
T4			.55
T5			
H1			
H2			
PR1			
PR2			
PR3			
PR4			
PR5			
PR6			
PR7			

TABLE XLVII

COMPARISON AMONG THREE LEVELS
OF TECHNOLOGICAL COMPLEXITY
FOR FACTOR 8

Factor Loading Technological Level			
Skill	Low	Medium	High
P1			
P2			
P3			
P4			.50
P5			
D1			
D2			
D3			
D4			
PS1			
PS2			
PS3			
PS4			
C1			
C2			
C3			
C4			
C5			
C6			
C7			
C8			
C9			
T1			
T2			
T3			
T4			
T5			
H1			
H2			
PR1			
PR2			
PR3			
PR4			
PR5			
PR6			
PR7			

3. Factor 4:

   A. Contains a cluster of skills for the high technological complexity level reflecting a concern for empathetic personal communication through listening, accepting, and informing.

   B. Contains a cluster of skills for the medium technological complexity level reflecting a concern over communication with superiors through both formal reports and personal contact.

Summary of Results

Through an analysis of variance and comparison of rank order, the relative importance of the following mangerial skills was not found to be significantly related to the technological complexity of the job. Representing a cluster of common core skills, they have been grouped by quartile with respect to overall importance.

First Quartile:

1. Ability to use time effectively,
2. Ability to set priorities on work,
3. Ability to inform superior,
4. Ability to identify solutions to problems,
5. Ability to delegate,
6. Ability to motivate people,
7. Ability to recognize and analyze problems, and
8. Ability to decide which solution is best.

Second Quartile:

1. Ability to conduct on-the-job training,

2. Ability to inform subordinates,
3. Ability to assign work to people, and
4. Ability to select people for jobs.

Third Quartile:

1. Ability to conduct appraisal discussions,
2. Ability to develop plans,
3. Ability to determine what training people should have,
4. Ability to counsel people with discipline problems,
5. Ability to interview job candidates, and
6. Ability to understand people.

Fourth Quartile:

1. Ability to answer questions on personnel practices,
2. Ability to evaluate the effect of training,
3. Ability to budget,
4. Ability to lead meetings,
5. Ability to develop individual development plans,
6. Ability to conduct formal briefings,
7. Ability to recommend awards,
8. Ability to develop material for formal classroom training, and
9. Ability to conduct formal classroom training.

In addition, significant differences in relative importance were found for the following nine managerial skills across levels of technological complexity:

1. The ability to make decisions in emergencies is significantly more important to the medium and high levels than to the low level.

2. The abilities to listen and accept views of others and to set objectives or develop projects are significantly more important to the medium level than to the low level.
3. The abilities to relate negative information, to complete reports and forms and to write formal letters are significantly more important to the high level than to the low level.
4. The abilities to develop work standards and to measure people are significantly more important to the medium level than to the high level.
5. The ability to recommend discipline is significantly more important to the medium level than either the low or high level.

And finally, a factor analysis of skill importance responses was conducted for each level of technological complexity. Along with an identification of a common core of skills containing significant loadings on 19 of the 27 common skills across at least two levels of technological complexity, the following unique skill clusters were identified with a particular level of technological complexity:

1. Low Level of Technological Complexity

   A. Oral Presentation & Written Communication Cluster
      1) Ability to Conduct Formal Briefings
      2) Ability to Lead Meetings
      3) Ability to Develop Material for Formal Classroom Training
      4) Ability to Conduct Formal Classroom Training
      5) Ability to Complete Reports & Forms
      6) Ability to Write Formal Letters

   B. Personnel Budgeting Cluster
      1) Ability to Budget
      2) Ability to Develop Individual Development Plans
      3) Ability to Recommend Awards

2. Medium Level of Technological Complexity

A. Personnel Problem Solving
1) Ability to Identify Solutions to Problems
2) Ability to Decide Which Solution is Best
3) Ability to Make Decisions in Emergencies
4) Ability to Understand People
5) Ability to Counsel People with Discipline Problems
6) Ability to Interview Job Candidates
7) Ability to Set Objectives or Develop Projects
8) Ability to Recommend Discipline

B. Upward Communication Cluster
1) Ability to Inform Superior
2) Ability to Complete Reports and Forms

3. High Level of Technological Complexity

A. Staff Meeting Cluster
1) Ability to Inform Superior
2) Ability to Inform Subordinates
3) Ability to Develop Plans
4) Ability to Lead Meetings
5) Ability to Motivate People

B. Formal Problem Solving Cluster
1) Ability to Recognize and Analyze Problems
2) Ability to Identify Solutions to Problems
3) Ability to Decide Which Solution is Best
4) Ability to Complete Reports and Forms

C. Interpersonal Communiation Cluster
1) Ability to Listen and Accept Views of Others
2) Ability to Answer Questions on Personnel Practices

CHAPTER IV

REVIEW AND IMPLICATIONS

This chapter will review the results of the experiment and discuss the implications for the training and development profession.

Review

The assessment of training and development needs for supervisors and managers must depend on an increasingly more precise estimate of an ideal role model of important skills for each job. Borrowing the concept of job technology from contingency management theorists, it has been possible to identify nine managerial skills and seven managerial skill clusters which are related to a measurable situational variable, job technology. A second group of skills has been identified and their relative importance determined which may be forming the basis for a common core of skills independent of job technology.

Implications

Based upon these research findings, the training and development practitioner will be better prepared to: identify ideal managerial role models; use a systematic approach to participant selection for training and development activities; and identify areas of emphasis in managerial training and development activities.

Ideal Managerial Role Models

This research has provided empirical evidence to strongly suggest a basic framework for building ideal managerial role models. From these results, the following tables have been constructed for each level of technological complexity. An assessment of the relative complexity of an individual's job technology would be used to identify the most appropriate profile to apply as the ideal role model. The determination of skill deficiencies should be concentrated in those skills which are relatively more important to job performance, as well as those skill clusters associated with the measured level of technological job complexity. From this information, training experiences could be identified which would address the most critical areas of job performance and productivity.

Assuming that an accurate assessment of future job technology could be made, this same process could be applied to identify skill deficiencies due to planned changes in job technology. Developmental experiences could be designed around current weaknesses as preparation of future technological demands due to planned promotions, transfers or reorganizations.

Since significantly different ideal managerial role models are defined by the level of technological job complexity, different standards against which skill deficiencies are to be identified should be applied. The procedure outlined above should facilitate the identification of skill deficiencies which are relatively important to job performance and, as a consequence, improve upon the efficiency and effectiveness of training or developmental activities.

TABLE XLVIII

PROFILE OF RELATIVE SKILL IMPORTANCE AND SKILL CLUSTERS ASSOCIATED WITH LOW TECHNOLOGICAL COMPLEXITY MANAGERIAL JOBS

Skill	Skill Cluster A	Skill Cluster B	Relative Skill Importance By Quartile 4th	3rd	2nd	1st
P1: Set Objectives				•		
P2: Develop Plans				•		
P3: Set Priorities						•
P4: Budget		•	•			
P5: Use Time Efectively						•
D1: Assign Work					•	
D2: Delegate						•
D3: Motivate						•
D4: Understand People				•		
PS1: Recognize, Analyze Problems						•
PS2: Identify Problem Solutions						•
PS3: Choice Of Best Solution						•
PS4: Emergency Decision Making					•	
C1: Inform Superior						•
C2: Inform Subordinates					•	
C3: Answer Personnel Questions			•			
C4: Conduct Formal Briefings	•		•			
C5: Lead Meetings	•		•			
C6: Listen and Accept Views					•	
C7: Relate Negative Information				•		
C8: Complete Reports, Forms	•			•		
C9: Write Formal Letters	•		•			
T1: Determine Training Needs				•		
T2: Conduct O.J.T.					•	
T3: Develop Training Materials	•		•			
T4: Conduct Formal Training	•		•			
T5: Evaluate Training Effectiveness			•			
H1: Interview Job Candidates				•		
H2: Select Job Candidates					•	
PR1: Develop Work Standards					•	
PR2: Measure People					•	
PR3: Conduct Appraisal Discussions				•		
PR4: Develop Individual Development Plans		•	•			
PR5: Recommend Awards		•	•			
PR6: Recommend Discipline				•		
PR7: Counsel People With Discipline Problems				•		

TABLE XLIX

PROFILE OF RELATIVE SKILL IMPORTANCE AND SKILL CLUSTERS ASSOCIATED WITH MEDIUM TECHNOLOGICAL COMPLEXITY MANAGERIAL JOBS

Skill	Skill Cluster		Relative Skill Importance By Quartile			
	A	B	4th	3rd	2nd	1st
P1: Set Objectives	•				•	
P2: Develop Plans				•		
P3: Set Priorities						•
P4: Budget			•			
P5: Use Time Efectively						•
D1: Assign Work					•	
D2: Delegate						•
D3: Motivate						•
D4: Understand People	•			•		
PS1: Recognize, Analyze Problems						•
PS2: Identify Problem Solutions	•					•
PS3: Choice Of Best Solution	•					•
PS4: Emergency Decision Making	•					•
C1: Inform Superior		•				•
C2: Inform Subordinates					•	
C3: Answer Personnel Questions			•			
C4: Conduct Formal Briefings			•			
C5: Lead Meetings			•			
C6: Listen and Accept Views					•	
C7: Relate Negative Information				•		
C8: Complete Reports, Forms		•			•	
C9: Write Formal Letters				•		
T1: Determine Training Needs				•		
T2: Conduct O.J.T.					•	
T3: Develop Training Materials			•			
T4: Conduct Formal Training			•			
T5: Evaluate Training Effectiveness			•			
H1: Interview Job Candidates	•			•		
H2: Select Job Candidates					•	
PR1: Develop Work Standards					•	
PR2: Measure People					•	
PR3: Conduct Appraisal Discussions				•		
PR4: Develop Individual Development Plans			•			
PR5: Recommend Awards			•			
PR6: Recommend Discipline	•			•		
PR7: Counsel People With Discipline Problems	•			•		

TABLE L

PROFILE OF RELATIVE SKILL IMPORTANCE AND SKILL CLUSTERS ASSOCIATED WITH HIGH TECHNOLOGICAL COMPLEXITY MANAGERIAL JOBS

Skill	Skill Cluster A	B	C	Relative Skill Importance By Quartile 4th	3rd	2nd	1st
P1: Set Objectives						•	
P2: Develop Plans	•				•		
P3: Set Priorities							•
P4: Budget				•			
P5: Use Time Efectively							•
D1: Assign Work						•	
D2: Delegate							•
D3: Motivate	•						•
D4: Understand People					•		
PS1: Recognize, Analyze Problems		•					•
PS2: Identify Problem Solutions		•					•
PS3: Choice Of Best Solution		•					•
PS4: Emergency Decision Making							•
C1: Inform Superior	•						•
C2: Inform Subordinates	•					•	
C3: Answer Personnel Questions			•	•			
C4: Conduct Formal Briefings				•			
C5: Lead Meetings	•			•			
C6: Listen and Accept Views			•			•	
C7: Relate Negative Information						•	
C8: Complete Reports, Forms		•					•
C9: Write Formal Letters						•	
T1: Determine Training Needs					•		
T2: Conduct O.J.T.						•	
T3: Develop Training Materials				•			
T4: Conduct Formal Training				•			
T5: Evaluate Training Effectiveness				•			
H1: Interview Job Candidates					•		
H2: Select Job Candidates						•	
PR1: Develop Work Standards					•		
PR2: Measure People					•		
PR3: Conduct Appraisal Discussions					•		
PR4: Develop Individual Development Plans				•			
PR5: Recommend Awards				•			
PR6: Recommend Discipline				•			
PR7: Counsel People With Discipline Problems					•		

Participant Selection

In those situations where the response to a training program has exceeded a predetermined number or where planned group exercises call for a subdivision of the program participants, the job technology instrument could be administered and used to split a heterogeneous group into smaller more homogeneous groups prior to or during program delivery. By dividing the participants into groups which have similar levels of technological job complexity, the process of bringing together people with similar skill priority patterns and their associated job problems would be facilitated. This application should improve the quality and quantity of group interaction thus enhancing the learning process.

Emphasis Areas

With a similar application, the job technology instrument could be administered to program participants as a means of identifying the predominant level of technological job comlexity represented. An examination of the appropriate profile would provide valuable guidance in the selection of emphasis areas within the broader context of the program design. For example, a general communication program might concentrate on oral presentations for low level technological complexity participants, upward communication for medium level particpants or interpersonal communication for high level participants. If the audience is equally diverse in the levels of technological job complexity represented, a case should be made for redesigning the general course into seperate courses which address the specific needs of these levels.

Future Research Needs

The results of this study imply the need for future research to (a) validate these findings and (b) identify and measure the effect on the ideal managerial role models of other situational factors and the interactive effect these factors may have with job technology. Concerning this second area of inquiry, examples of other situational factors could include: the quality of work life; the physical environment; the leadership style of the superior; the maturity level of subordinates. Since all aspects of the manager's environment are subject to change over time, the need exists to constantly measure for skill deficiencies. With these and future research efforts, the ideal managerial role models will provide a theoretically sound framework from which the effects of change can be anticipated. Assuming that managerial skill deficiencies exist and that time to respond is available, training and development activities can be identified which could assist the manager in the transition from one role model to another.

Two of the most useless exercises in training and development may be (a) delivery of the right program to the wrong audience and (b) delivery of the program after the fact; that is, when time to respond is too critically short to allow for an assimilation and implementation of newly acquired skills, knowledge and attitudes. It is anticipated that these and similar future efforts will focus closer attention on the effects of change and the role which training and development can play in facilitating the change process.

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APPENDIXES

APPENDIX A

QUESTIONNAIRE

Your Training Needs

I. The following questions are designed for you to identify the relative importance of various skills as applied to your current job responsibilities and measure whether additional training would be useful.

It is anticipated that some of these skills may be more important to you than others. As such, it may be beneficial to scan through them prior to your evaluation. Your response to all items will assist in the development of an accurate needs analysis from which future training programs can be developed.

	This is important to my job (Circle a number)					I would like additional training (Circle a number)				
	Not Important				Very Important	Low Need				High Need
PLANNING										
1. Ability to set objectives or develop projects	1	2	3	4	5	1	2	3	4	5
2. Ability to develop plans	1	2	3	4	5	1	2	3	4	5
3. Ability to set priorities on work	1	2	3	4	5	1	2	3	4	5
4. Ability to budget	1	2	3	4	5	1	2	3	4	5
5. Ability to use time effectively	1	2	3	4	5	1	2	3	4	5
DIRECTING										
1. Ability to assign work to people	1	2	3	4	5	1	2	3	4	5
2. Ability to delegate	1	2	3	4	5	1	2	3	4	5
3. Ability to motivate people	1	2	3	4	5	1	2	3	4	5
4. Ability to understand people of different ages, races, backgrounds, etc.	1	2	3	4	5	1	2	3	4	5
PROBLEM-SOLVING										
1. Ability to recognize and analyze problems	1	2	3	4	5	1	2	3	4	5
2. Ability to identify solutions to problems	1	2	3	4	5	1	2	3	4	5
3. Ability to decide which solution is best	1	2	3	4	5	1	2	3	4	5
4. Ability to make decisions in emergencies	1	2	3	4	5	1	2	3	4	5
COMMUNICATION										
1. Ability to inform superiors	1	2	3	4	5	1	2	3	4	5
2. Ability to inform subordinates	1	2	3	4	5	1	2	3	4	5
3. Ability to answer questions on personnel practices (merit promotion, EEO, classification, etc.)	1	2	3	4	5	1	2	3	4	5

	This is important to my job (Circle a number)					I would like additional training (Circle a number)				
	Not Important				Very Important	Low Need				High Need
COMMUNICATION (con't.)										
4. Ability to conduct formal briefings	1	2	3	4	5	1	2	3	4	5
5. Ability to lead meetings	1	2	3	4	5	1	2	3	4	5
6. Ability to listen and accept view of others	1	2	3	4	5	1	2	3	4	5
7. Ability to relate negative information	1	2	3	4	5	1	2	3	4	5
8. Ability to complete reports and forms	1	2	3	4	5	1	2	3	4	5
9. Ability to write formal letters	1	2	3	4	5	1	2	3	4	5
TRAINING										
1. Ability to determine what training people should have	1	2	3	4	5	1	2	3	4	5
2. Ability to conduct on-the-job training	1	2	3	4	5	1	2	3	4	5
3. Ability to develop material for formal classroom training	1	2	3	4	5	1	2	3	4	5
4. Ability to conduct formal classroom training	1	2	3	4	5	1	2	3	4	5
5. Ability to evaluate the effect of training	1	2	3	4	5	1	2	3	4	5
HIRING										
1. Ability to interview job candidates	1	2	3	4	5	1	2	3	4	5
2. Ability to select people for jobs	1	2	3	4	5	1	2	3	4	5
PERFORMANCE REVIEW										
1. Ability to develop work standards	1	2	3	4	5	1	2	3	4	5
2. Ability to measure people . . .	1	2	3	4	5	1	2	3	4	5
3. Ability to conduct appraisal discussion	1	2	3	4	5	1	2	3	4	5
4. Ability to develop Individual Development Plans	1	2	3	4	5	1	2	3	4	5
5. Ability to recommend awards	1	2	3	4	5	1	2	3	4	5
6. Ability to recommend discipline	1	2	3	4	5	1	2	3	4	5
7. Ability to counsel people with discipline problems . . .	1	2	3	4	5	1	2	3	4	5

Your Job

II. The following is a set of questions relating specifically to your job and the unit in which you work.

There are a number of aspects concerning the nature of the tasks which people perform in organizations which contribute to the manner in which those tasks are completed. This section contains several sets of questions or statements to which we would like your response in describing the nature of the task which you are responsible for performing. Instructions precede each set. Please respond to each question as you feel best describes your job.

Time Perspectives

Instructions. Persons working on different activities are concerned to different degrees with future and current problems. This part asks how your time is divided between activities which will have an immediate effect on your department's results and those which are of a longer range nature. Please indicate below what percent of your time is devoted to working on matters which will affect results within each of the periods indicated. Your answer should total 100%.

1. 1 day to 1 week . . . . ________% 1
2. 1 week to 1 month . . . . ________% 2
3. 1 month to 6 months . . . . ________% 3
4. 6 months to 1 year . . . . ________% 4
5. 1 year to 2 years . . . . ________% 5
6. 2 years or more . . . . ________% 6

________% total

Task Complexity

Task complexity refers to the degree to which your job is comprehensible and understandable by one person. Please answer each question by circling the degree to which you agree or disagree with each of the following statments, except for statement 6 which asks you to place a check mark beside certain items.

1. Complete personal discretion is given to me in accomplishing my work.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1	2	3	4	5	6

2. For doing most of the things required by my task, there are standardized procedures which must be followed.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1	2	3	4	5	6

3. The jobs (tasks) assigned to employees in my department are completely independent of each other.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1	2	3	4	5	6

4. Most of the things which I do in my job are routine and repetitive.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1	2	3	4	5	6

5. The overall complexity of my department's objectives, assignments, or tasks is quite high.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1	2	3	4	5	6

6. Please place a check mark beside the various aspects of your job in which you are allowed personal discretion, i.e., your supervisor does not give you specific instructions.

Scheduling of work completion	______________
Speed of work	______________
Selection of specific assignments	______________
Making decisions on work methods	______________
Making decisions on work objectives	______________
Other:____________________________	______________
I am not allowed discretion	______________

APPENDIX B

GRAPHICAL REPRESENTATION OF

SIGNIFICANT RELATIONSHIPS

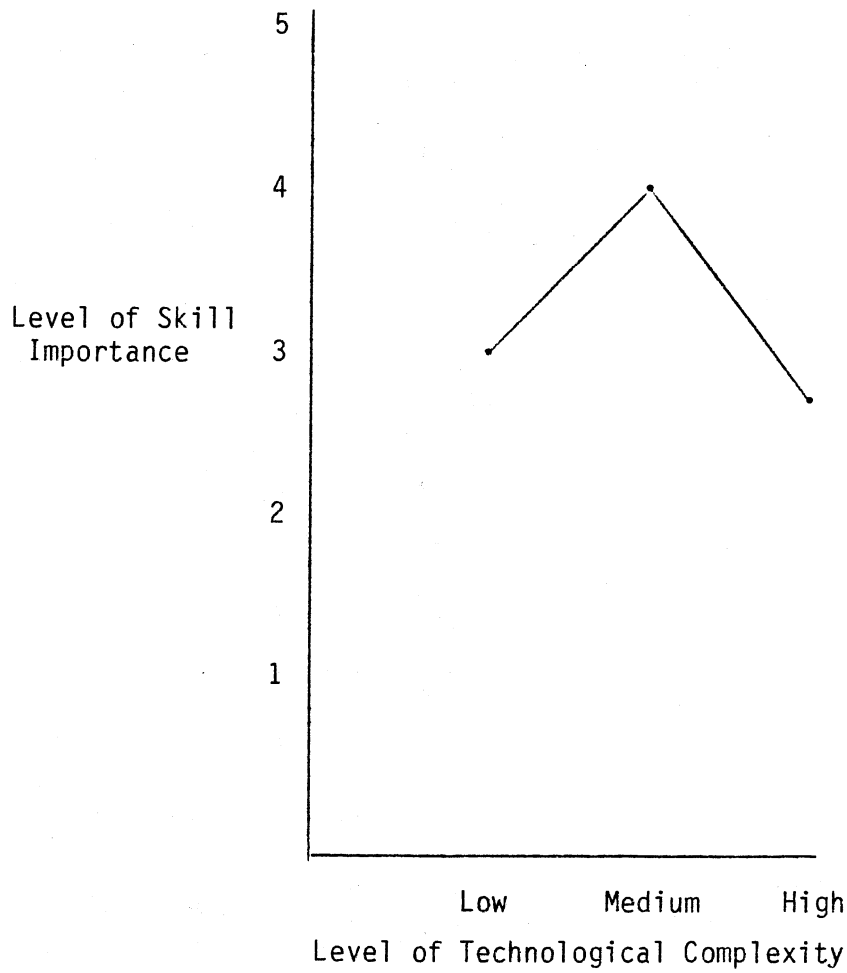

Figure 1. Ability to Answer Questions on Personnel Practices (C3)

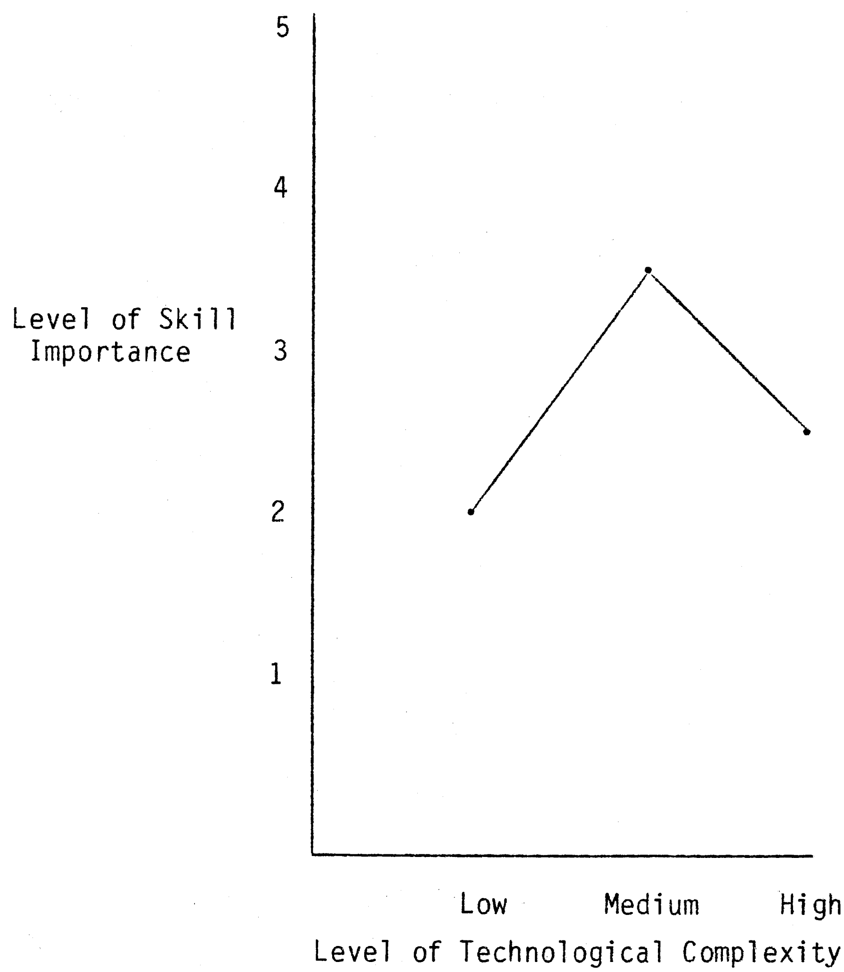

Figure 2. Ability to Conduct Formal Briefings (C4)

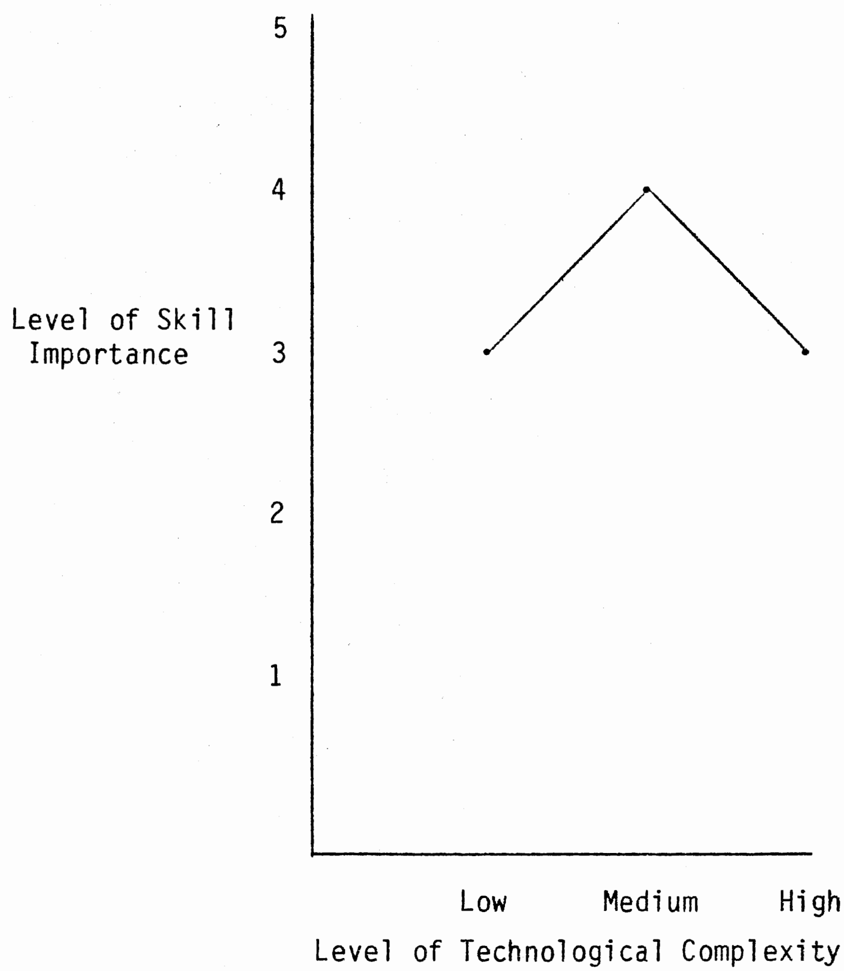

Figure 3. Ability to Recommend Discipline (PR6)

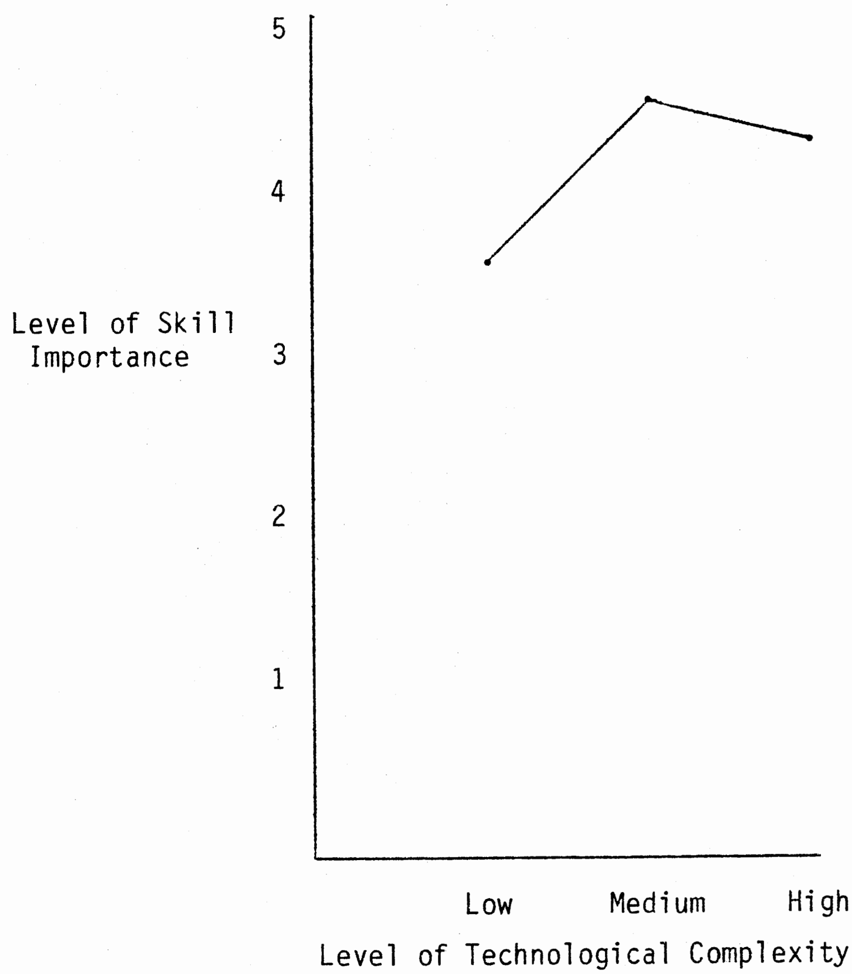

Figure 4. Ability to Make Decision in Emergencies (PS4)

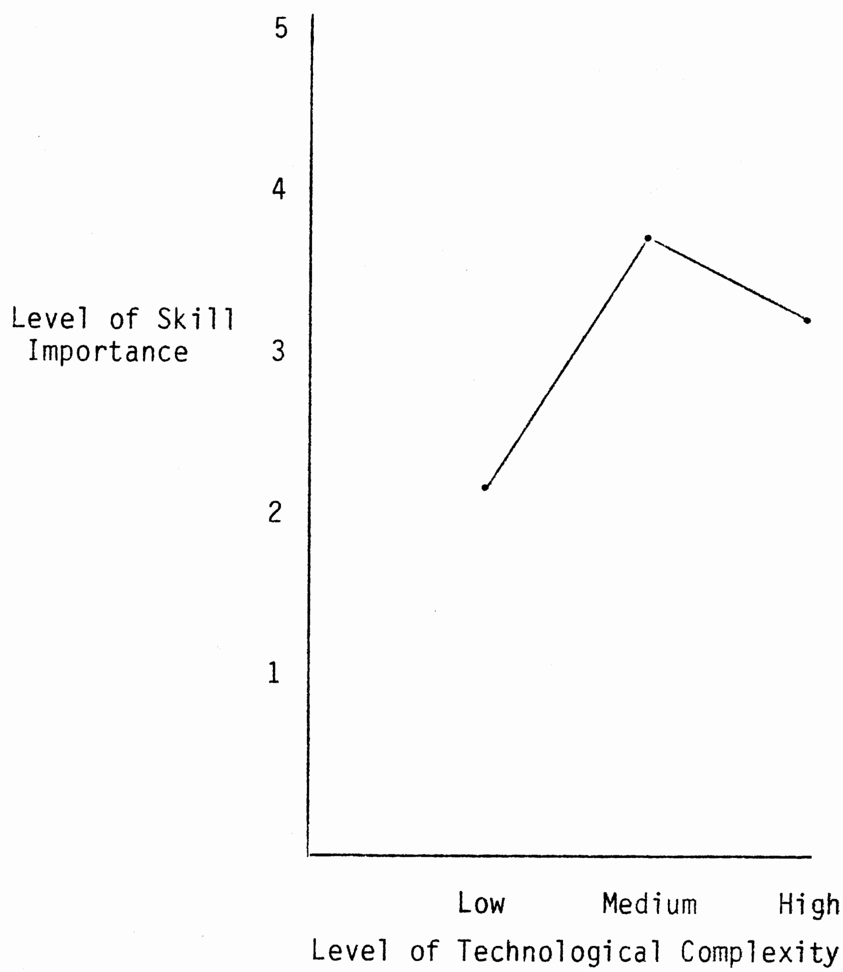

Figure 5. Ability to Lead Meetings (C5)

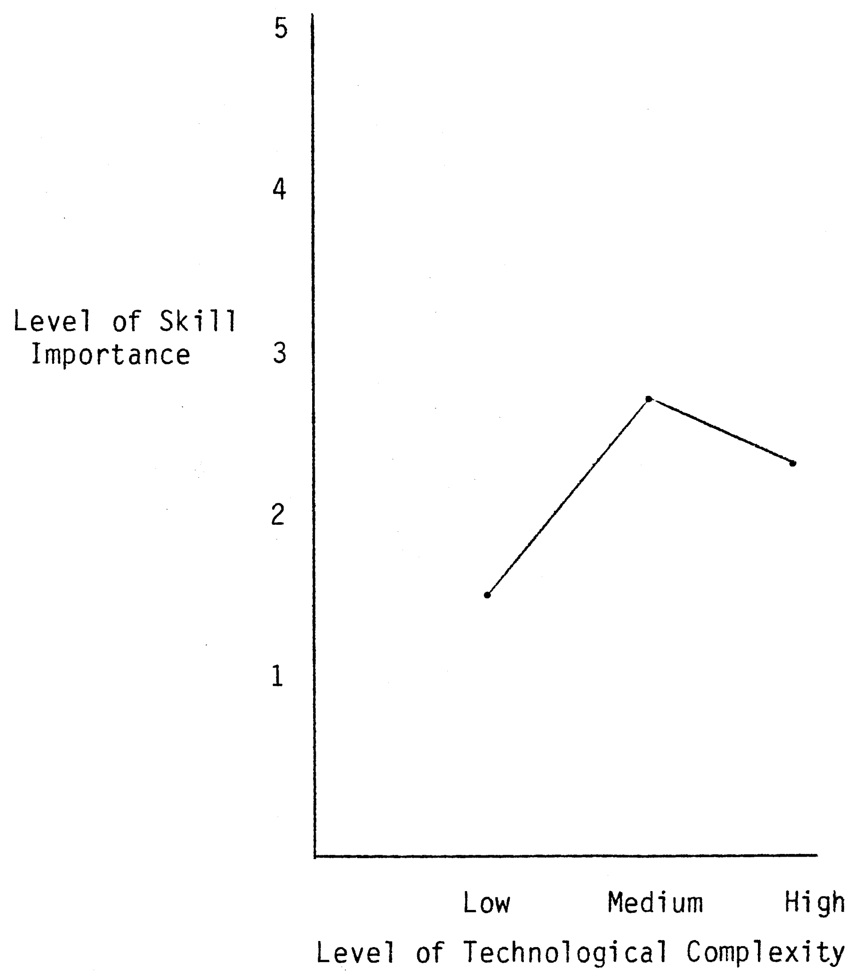

Figure 6. Ability to Develop Material for Classroom Training (T3)

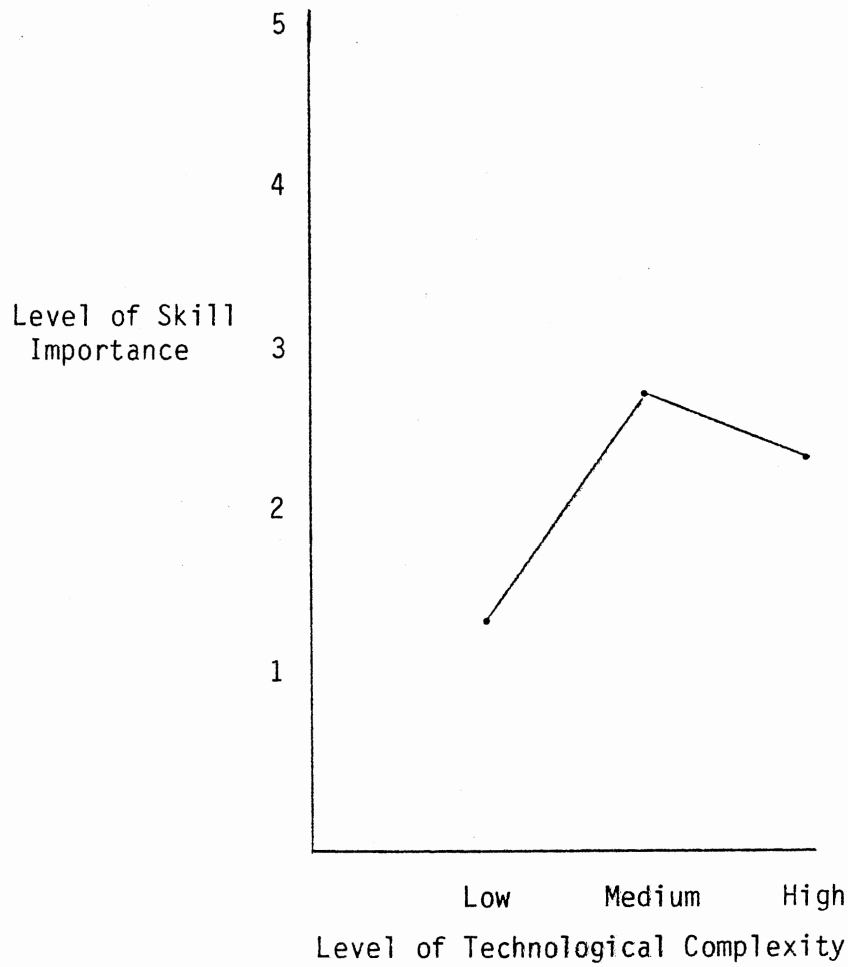

Figure 7. Ability fo Conduct Formal Classroom Training (T4)

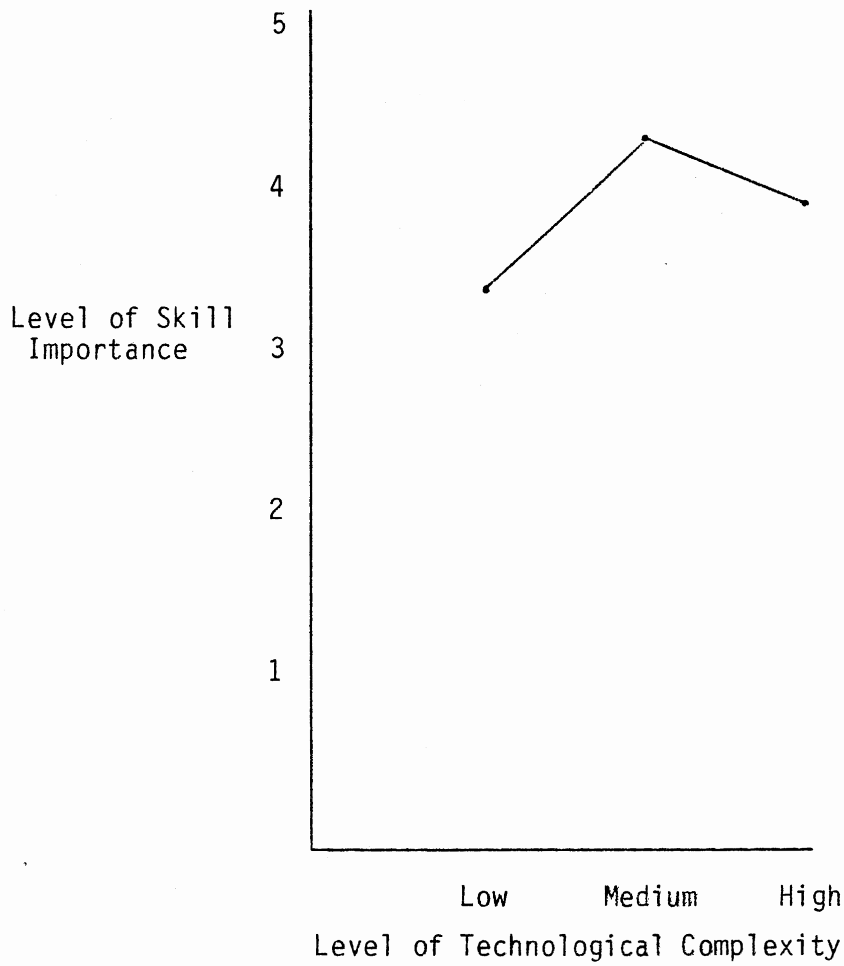

Figure 8. Ability to Set Objectives or Develop Projects (P1)

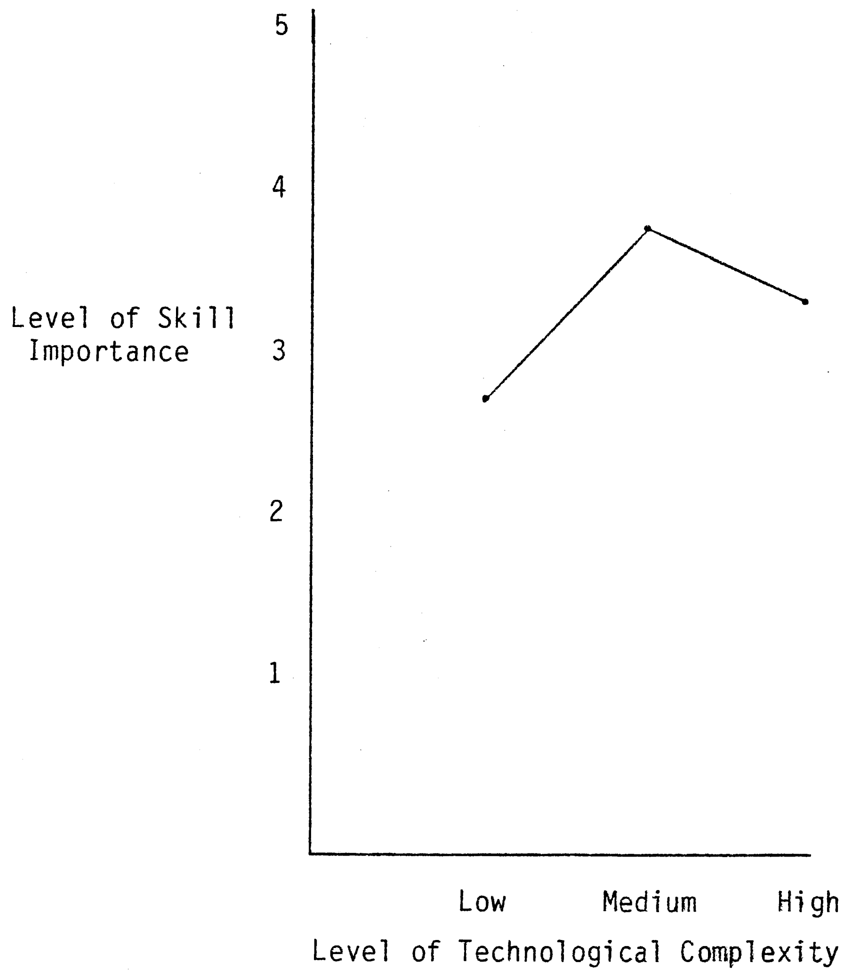

Figure 9. Ability to Budget (P4)

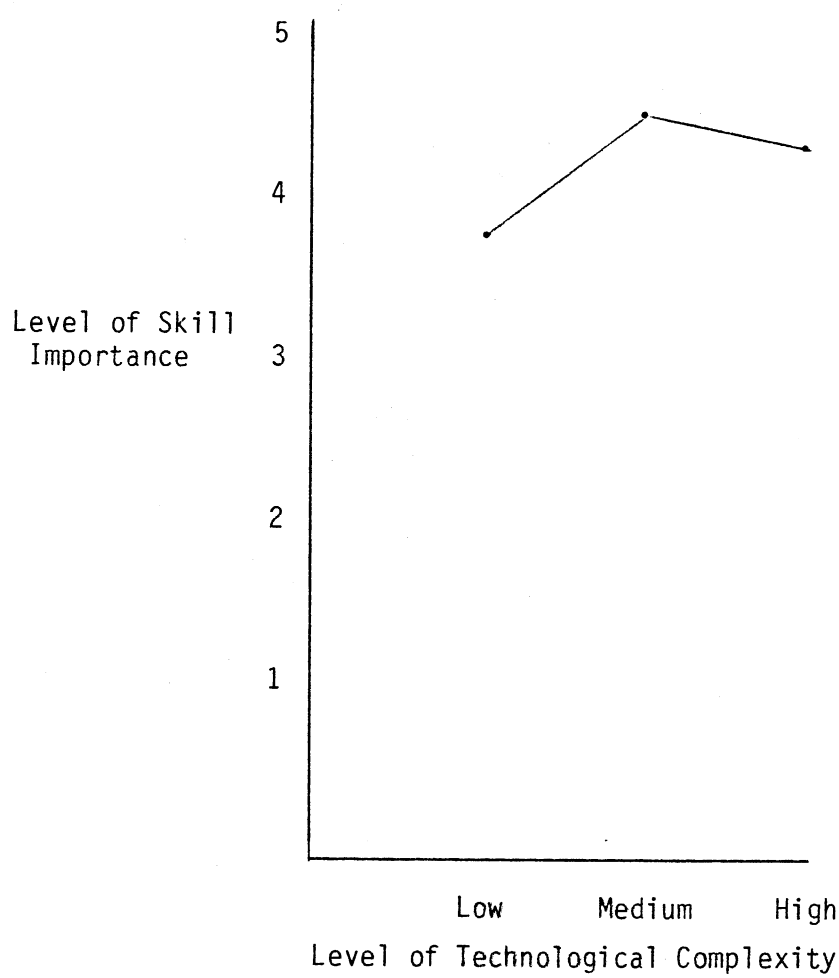

Figure 10. Ability to Listen and Accept Views of Others (C6)

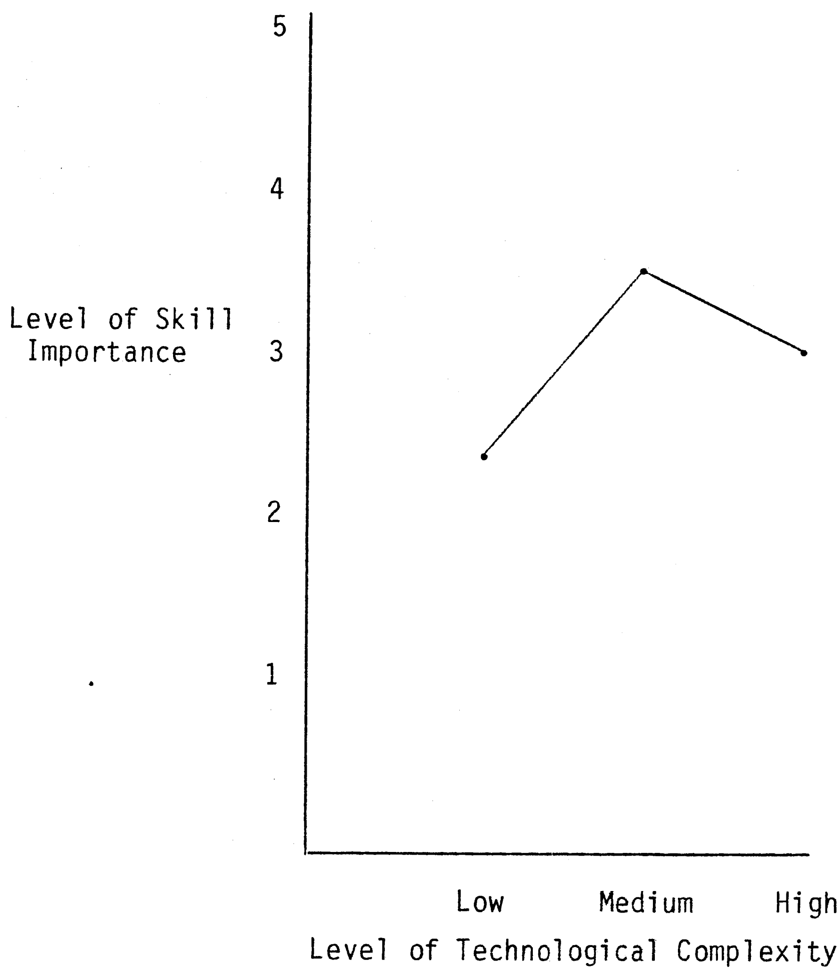

Figure 11. Ability to Develop Individual Development Plans (PR4)

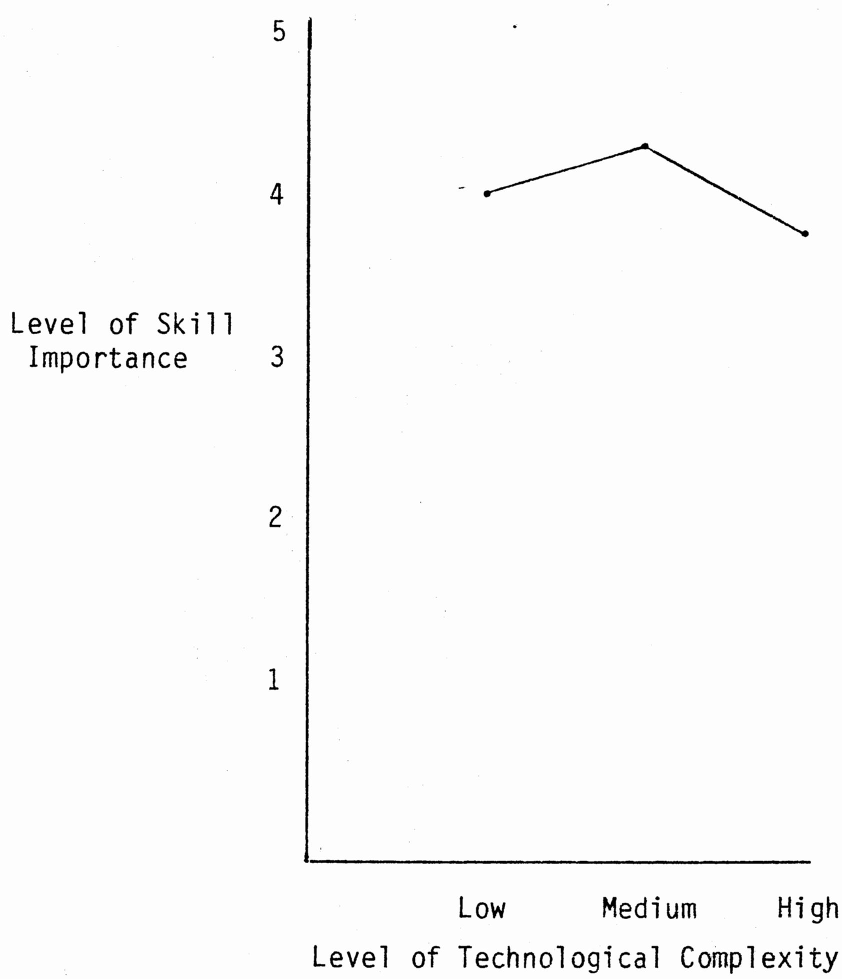

Figure 12. Ability to Develop Work Standards (PR1)

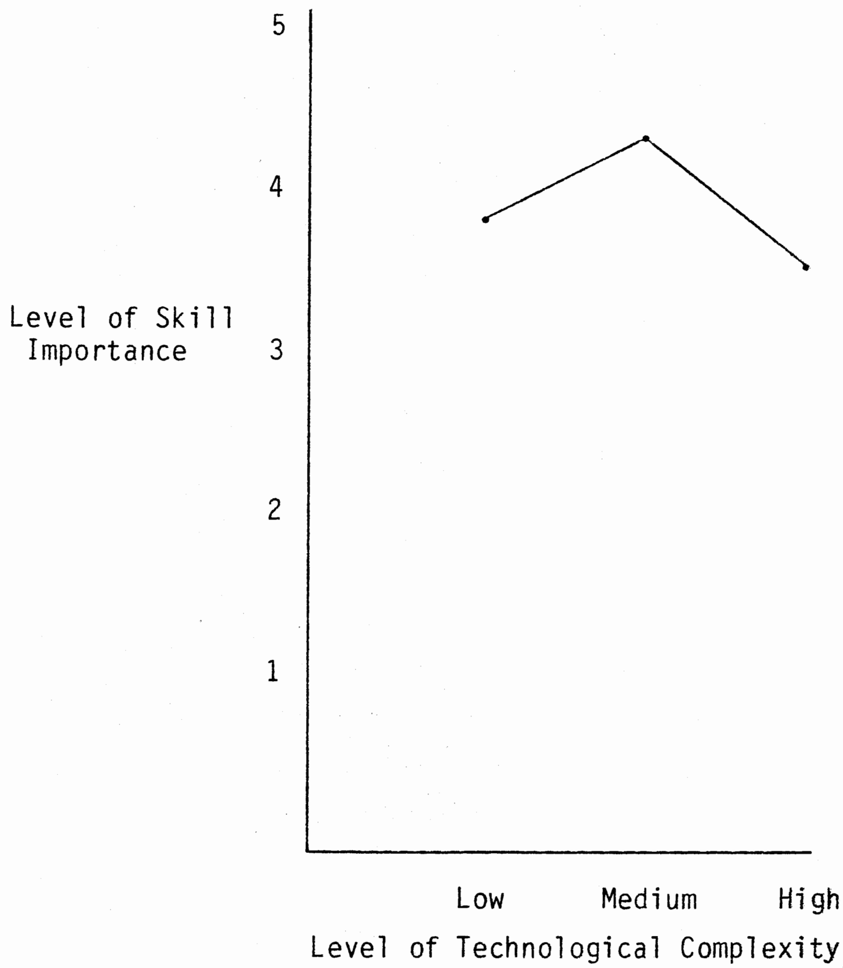

Figure 13. Ability to Measure People (PR2)

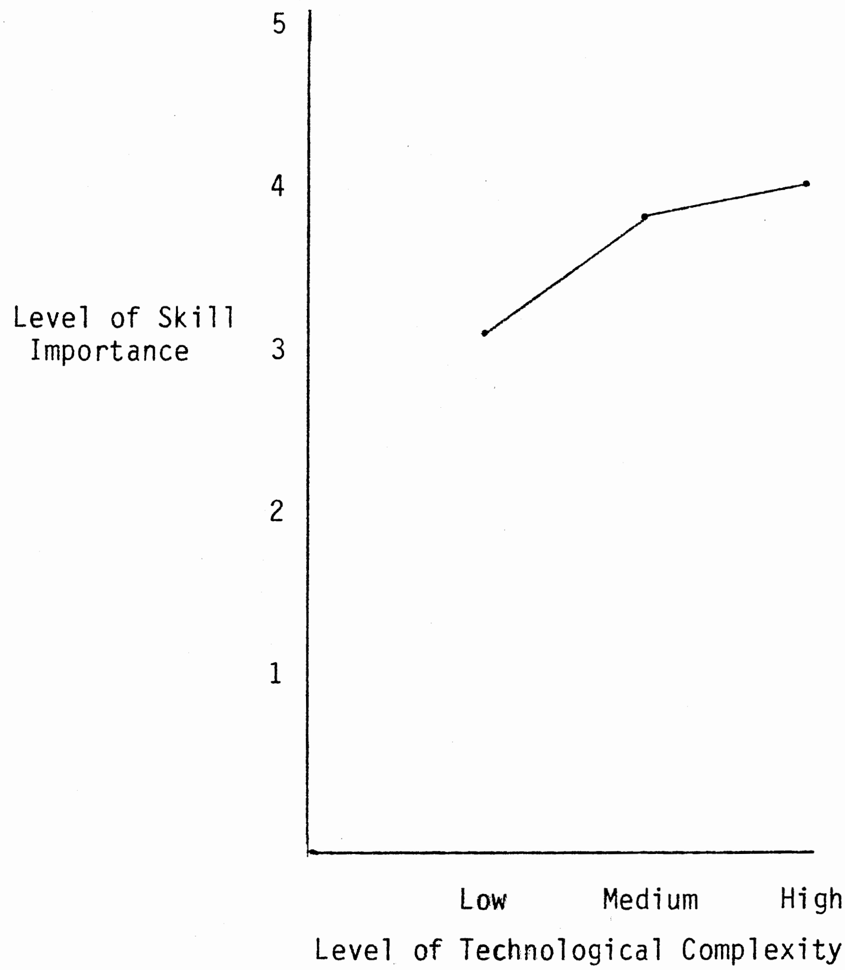

Figure 14. Ability to Relate Negative Information (C7)

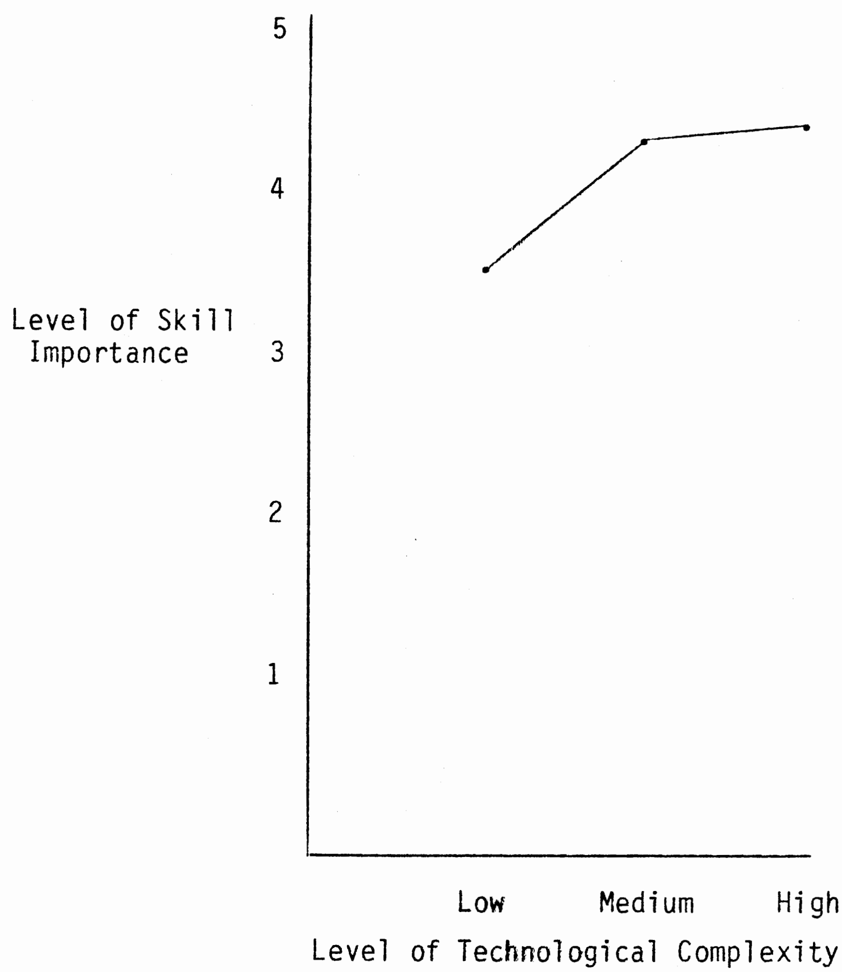

Figure 15. Ability to Complete Reports and Forms (C8)

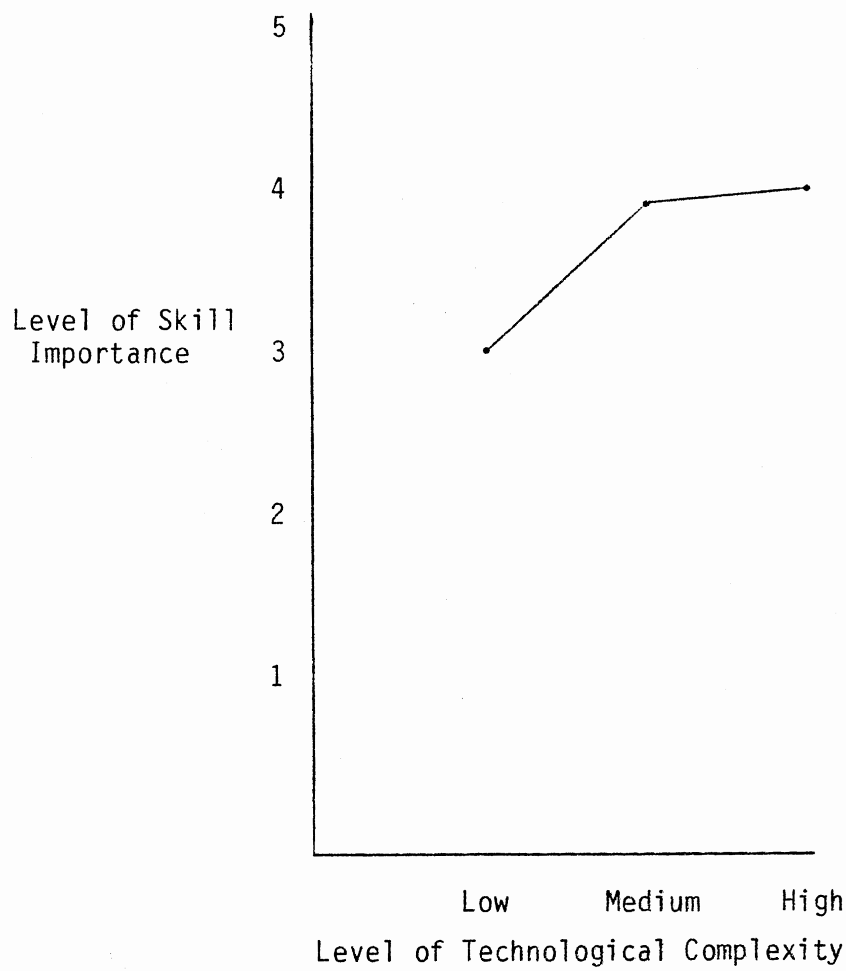

Figure 16. Ability to Write Formal Letters (C9)

VITA

Mark Michael Vincent

Candidate for the Degree of

Doctor of Education

Thesis: AN EXPERIMENTAL ASSESSMENT OF JOB TECHNOLOGY EFFECTS ON MANAGERIAL TRAINING AND DEVELOPMENT NEEDS

Major Field: Business Education

Biographical:

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