DEVELOPMENT OF LEADERSHIP SKILLS: EXPERIENCE AND TIMING

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To develop organizational leaders we need to understand how requisite skills are acquired over the course of people's careers. In this article, a cross-sectional design was used to assess differences in leadership skills across six grade levels of officers in the U.S. Army. Increased levels of knowledge, problem-solving skills, systems skills, and social skills were found at higher grade levels. Certain skills and experiences, however, were found to be particularly important at certain phases of leaders' careers. These findings are used to propose an organization-based model of skill development. Implications of this model for leader development programs are discussed.

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INTRODUCTION

Few of us would disagree with the proposition that, under certain conditions, leaders have an enormous impact on organizations (Day & Lord, 1988; Hogan, Curphy, & Hogan, 1994). Many organizations have, as a result, initiated programs intended to enhance leader performance. Assessment and selection programs reflect one strategy frequently used to improve leader performance (Bray, Campbell, & Grant, 1974; Russell & Kuhnert, 1992). Another strategy commonly employed is based on a developmental approach. Training, monitoring and career pathing programs are devised in the hope of producing leaders with the skills needed on their jobs.

Discussions of leader development have a distinctly practical bent. A question often asked by researchers and practitioners is "How can we develop people to ensure effective leadership?" When one considers skills-based theories, a broader set of theoretical questions comes to mind: Is there reason to suspect that skills develop as a function of experience? If skills improve as a function of experience, exactly what kinds of experiences contribute to skill increases at different points in leaders' careers? Our intent in this article is to examine the leadership skills proposed by Mumford, Zaccaro, Harding, Jacobs, and Fleishman (2000) and how they differ across multiple organizational levels as a function of experience in organizational leadership roles.

Skill Acquisition

Psychologists have an interest in the factors that contribute to the acquisition of skilled performance (Ericcson & Charress, 1994). Broadly speaking, studies of skill acquisition have progressed along two distinct lines. One line of research has focused on the structure of skill acquisition as people practice certain tasks (Ackerman, 1987; Fleishman, 1972). The second line of research has focused on the processes involved as people acquire knowledge and skills in different domains of experience (Anderson, 1993).

Traditionally, studies of skill acquisition have sought to understand how performance improves over time as a function of practice. In initial studies along these lines, Fleishman and his colleagues (Fleishman & Hempel, 1955; Fleishman & Mumford, 1989) found that although performance improves with practice, the factors contributing to skill acquisition in the early stages of practice are not identical to those influencing performance in the later stages of practice. Typically, broad common abilities, such as intelligence, evidence their strongest effects during the early stages of skill acquisition while other more narrow abilities influence performance in the later stages of skill acquisition. In a recent extension of this work, Ackerman (1989, 1991) proposes a three-stage model of skill acquisition. He proposes that skill acquisition proceeds first by people acquiring an understanding of task performance requirements, to response assembly, where developing performance capabilities are integrated, to a final stage where performance becomes automated.

These performance-based models of skill acquisition have a number of noteworthy implications for any attempt to understand skill development, including the development of leadership skills. They indicate that with experience, the factors

that influence further development may not be identical to those that influence development early on. Thus, useful experiences at one phase in leader's careers may not be useful at other phases. Second, the kinds of errors made at one phase in a leader's career may be different than the kinds of errors occurring later (Mumford, Costanza, Baughman, Threlfall, & Fleishman, 1994). Third, characteristics associated with knowledge acquisition (e.g., intelligence and mastery motives) appear particularly important early in the skill acquisition process. Characteristics associated with performance application (e.g., task allocation and focus) are more strongly linked to later performance (Ackerman & Kanfer, 1993; Mumford, Baughman, Costanza, Uhlman, & Connelly, 1993).

In contrast to this performance-based approach, studies of cognition have focused on how people acquire expertise in different domains of education (Chi, Glaser, & Rees, 1982; DeGroote, 1965; Goldsmith, 1991; Qin & Simon, 1990; Seigler & Richards, 1982). Broadly speaking, these studies indicate that expertise develops slowly over periods of ten years or more. Experts differ from novices in that they have a greater number of concepts available, organize information on the basis of identifying principles, and are capable of applying concepts in a flexible fashion contingent on key characteristics of the situation. More recent research has extended these findings by looking for variables, primarily educational interventions, which will accommodate the development of expertise. For example, Chi, Bassock, Lewis, Reiman, and Glaser (1989) found that active self-initiated application of principles can accelerate the development of expertise. Other studies by Sweller (1989) and Ward, Byrnes, and Overton (1990) have shown that performance may be enhanced by providing models for organizing and forming concepts, and appropriate strategies and procedures for applying these concepts.

Although these two lines of research have rather different goals, they paint a coherent picture of the skill acquisition process. Initially, people must acquire base concepts, learn what is expected of them, and apply these concepts in well-structured, relatively concrete situations. Next, these concepts must be elaborated and applied in more complex settings as people begin independent problem-solving and learn to apply different concepts in different settings. Finally, rapid integration of knowledge drawn from multiple sources and practice allows people to address complex, rapidly unfolding problems.

Developing Leadership Skills

When one considers the general model of skill development in relation to the model of leadership skills proposed by Mumford, Zaccaro, Harding, Jacobs, and Fleishman (2000), it has some implications for understanding the development of leadership skills. Leaders, no matter how gifted, initially enter organizations as novices. Thus, they lack basic concepts that provide them with an understanding of the work, organizational contexts, and leadership roles. As a result, the kinds of problems with which they are presented are typically highly structured, and the activities of these neophyte leaders are likely to be closely supervised. Performance in these structured, well-defined roles are necessarily situationally-contingent and often rely on technical and social skills that transfer from prior educational or work-

related experiences (Podsakoff, MacKenzie, & Bommer, 1996). During this period, educational and socialization issues are likely to be of paramount importance as novice leaders attempt to grasp and internalize the norms, laws and guiding vision of the organization (Schneider & Schneider, 1994).

After novice leaders have acquired some understanding of the organization and their place in it, the key issues at hand are two-fold. First, leaders must begin to elaborate their initial knowledge structures, integrating "real-world" experience into base concepts. Second, they must begin to organize the knowledge by independently tackling leadership problems, albeit relatively well-structured ones. Assignments where the leader has primary supervisory responsibilities and some limited discretion are likely to prove valuable in skill development. Commitment to organizational goals, the evaluation of others, and commitment to others are all likely to prove particularly important developmentally, along with an active ongoing involvement in developing others and oneself (Schmeck, 1988).

Reflection on initial learning effectiveness in independent supervisory roles provides a basis for the elaboration of knowledge and the emergence of principle-based knowledge structures (Lewis & Jacobs, 1992). With the emergence of more principle-based knowledge structures, it becomes possible for leaders to begin to develop and apply the kind of complex, creative thinking skills needed to solve the type of novel, ill-defined problems that represent critical determinants of leader performance (Baughman & Mumford, 1995). At this juncture, however, these skills may prove difficult to apply. Thus, assignments that present novel challenging problems and require working with others who have different perspectives may be valuable.

One implication of the Mumford, Zaccaro et al. (2000) model is that it is not enough for leaders to be able to solve novel, ill-defined organizational problems. They must also be capable of formulating solutions that will work in complex organizational environment, projecting downstream consequences, assessing risks and workability, coordinating with multiple constituencies and formulating overarching models and visions of long-term solutions (Conger & Kanungo, 1988; Tusi, 1984). Under these conditions, the development of complex organizational wisdom and perspective taking will be at a premium. Exercises that promote the acquisition of these skills and mentoring by experienced senior leaders should prove useful as well as assignments that present novel, challenging organizational problems calling for autonomy, risk taking, ongoing environmental assessment, and long-term solutions of multiple subsystems.

The model of leader development described above is depicted in Fig. 1. Although this model may seem quite straightforward, it has a number of important yet somewhat subtle implications. To begin, skill development may take a substantial period of time. It may take up to 20 years before leaders acquire all of the skills needed to solve novel, ill-defined organizational problems. Moreover, development in this sense is progressive, moving from simple knowledge structures and straightforward technical and social skills, to complex integrated knowledge structures that support the effective application of creative problem-solving and systems skills. Finally, it should be recognized that the kind of experiences which promote skill development at one point in a leader's career are different than those which may be beneficial later. To see this point, consider the predicament of a novice leader

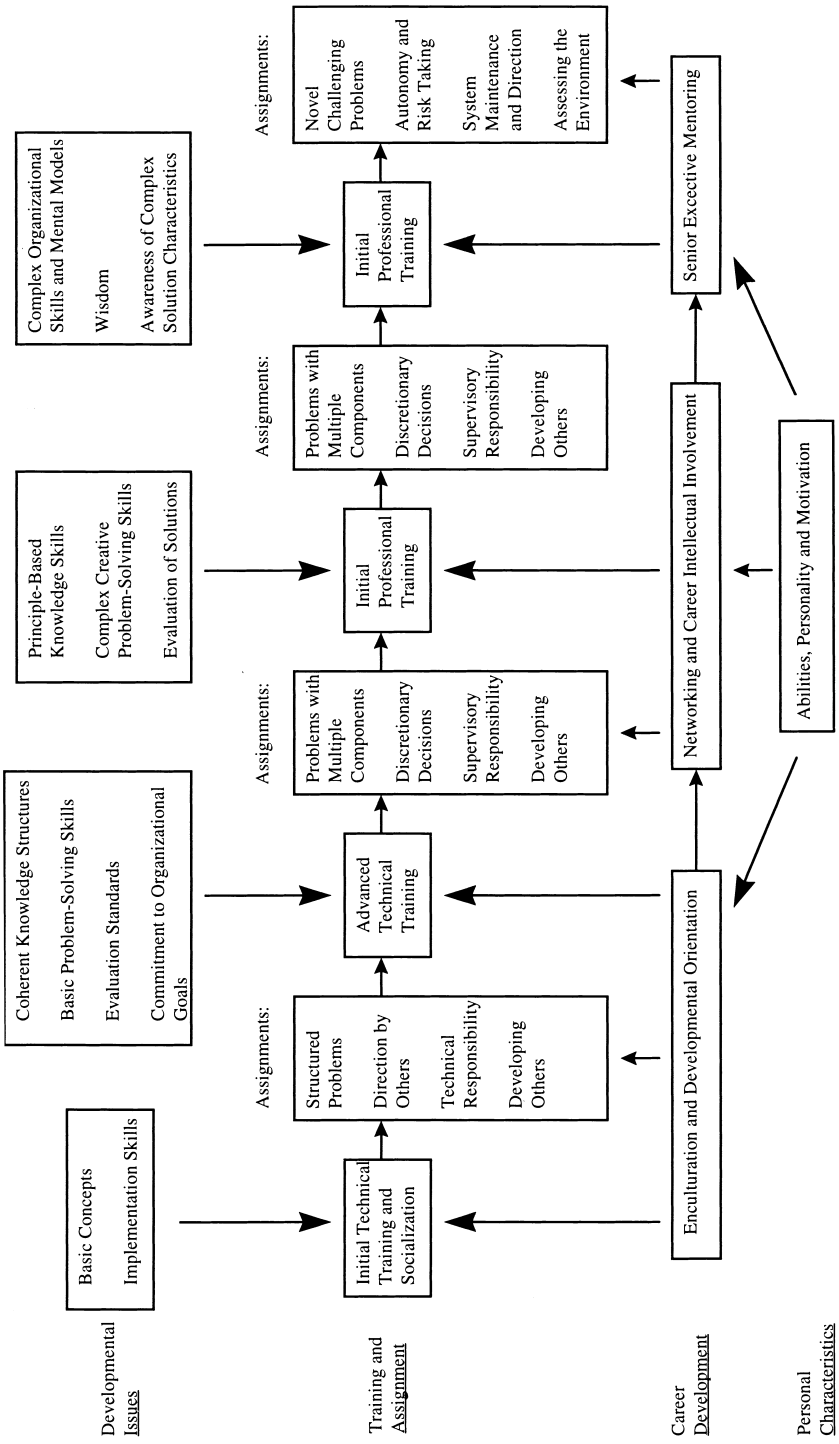

Figure 1. Conceptual Model of Leader Development

who must struggle to understand the somewhat Machiavellian motivations of an experienced senior executive. It is questionable whether the issues would be recognized, much less understood. Thus, effective developmental experiences will be those that lie within the individual's zone of proximal development.

Developmental Interventions

When considering the type of model presented above, it is easy to fall into the trap of assuming that leader development occurs automatically, always following the same pre-defined course. Skill development depends on learning as people interact with their environments (Lerner & Tubman, 1989; Mumford, 1992). One crucial influence on development is what the individual is capable of taking from his or her experience as a leader. This point is nicely articulated in the literature on management derailment factors where characteristics, such as insensitivity, a lack of openness, and sheer ego, act to inhibit both learning and the opportunity to learn through interactions with others (Kaplan, Drath, & Kofodimos, 1991; Lombardo, Ruderman, & McCauley, 1987). On a more positive note, other characteristics, such as intellectual involvement and a developmental orientation may promote learning through interaction, contributing to the development of requisite leadership skills (Schooler, 1990; Simonton, 1990).

Leaders' constructions and interpretations of environmental events are not the only influences on their development. The environmental opportunities to which they are exposed also exert an influence on the development of requisite leadership skills. For example, studies by Bray et al. (1974) and McCauley, Ruderman, Ohlott, and Morrow (1994) indicate that exposure to assignments presenting novel, challenging problems promotes the development of leadership skills presumably by stimulating the exercise of creative problem-solving and systems skills. It is important to note that careers in different organizations often do not provide the same opportunities for exposure to these types of assignments. Moreover, other kinds of assignments, such as sales and marketing assignments, may promote the development of other types of skills, including the interactional, communication and systems skills needed by leaders.

Assignments are not the only kinds of experiences that might promote the development of requisite leadership skills. Training can be viewed as an attempt to provide a set of systematic experiences to promote the development of certain knowledge and skills (Anderson, 1993). In fact, many available leadership training courses have received widespread praise. Unfortunately, evidence bearing on the ability of these programs to develop requisite leadership skills is often less than compelling (Zaccaro, 1996). Nevertheless, a few studies (e.g., Bass & Avolio, 1994; Streufort, Nogami, Swezey, Pogash, & Piasecki, 1988) indicate that well-timed training interventions can promote the development of certain problem-solving and systems skills.

These observations about influences on skill development bring us to the principal goals of the present study. First, we hope to show that leadership knowledge and skills increase as a function of experience. Second, assuming increases in skill levels across organizational levels are observed, we hoped to show that the pattern and

timing of skill level increases across organizational level are consistent with the model of leader development presented above. Third, and finally, we hoped to show that certain assignment characteristics, training courses, and career development orientations are correlated with skill levels at certain points in leaders' careers in accordance with their current phase of skill development.

METHOD

Sample

The sample used to test these ideas was obtained as part of a larger study of leadership among Army officers. A more detailed description of the sample may be obtained by consulting Zaccaro, Mumford, Connelly, Marks, and Gilbert (2000). This sample is unique in the sense that it contains leaders at different points in their military careers ranging from second lieutenants to colonels. Officers' ages range from 21 to 58. Moreover, members of this cross-sectional sample spent their careers in one organization, the Army, making it possible to assess developmental influences in a common organizational framework.

Based on the significance of company command and battalion command in the Army's career progression system, the sample was divided into three groups. The first group consisted of 1,160 second lieutenants, first lieutenants, and junior captains. Officers in this group had not yet been exposed to company command in the Army (i.e., a major leadership role). The average age of these officers was 27.47 (SD = 3.71), and they had 2.85 (SD = 2.68) years experience in Army leadership roles. The second group contained senior captains and majors who had company command experience but had not yet commanded a battalion, the first Army leadership role where officers are responsible for multiple component subsystems. The 410 officers in this group were, on average, 34.37 (SD = 3.26) years old and had been in the Army for 10.32 (SD = 2.60) years. The third group was composed of lieutenant colonels and colonels, all of whom had commanded battalions. The 220 lieutenant colonels and colonels in this third group were, on average, 44.52 (SD = 2.86) years old, having been in the Army for 20.98 (SD = 2.71) years.

Skill and Criterion Measures

The officers included in this sample were asked to complete a number of measures ranging from standardized tests intended to assess basic abilities and dispositional characteristics, to measures assessing some of the key leadership skills identified by Mumford et al. (2000). For the purpose of the present investigation, we will focus only on a limited subset of measures (i.e., those intended to capture leadership skills as opposed to measures of abilities, personality and motivation).

Table 1 provides a brief description of each skill measure. Detailed descriptions of these measures may be found in Zaccaro, Mumford, Connelly, Marks, and Gilbert (2000). Each measure that was presented to respondents is comprised of one or more tasks expressly selected to elicit certain skills. Responses to these written paper-and-pencil scenarios were rated by four judges, all doctoral candidates, with

Table 1. Measures of Leadership Skills

Measure	*Targeted Constructs*	*Description of Measure*	*Scoring Procedures*
Complex Problem Solving (Cued)	Problem construction, information encoding, category search, best-fitting categories, combination and reorganization, idea evaluation, solution implementation, monitoring	Presents a complex ill-defined military leadership problem. Probe questions and cues used to elicit responses on different creative problem-solving skills.	Three judges rate responses to appropriate questions to access effective application of the problem-solving skills. Scores obtained for each skill by averaging judges' ratings.
Solution Construction	Time frame of goals, attention to restrictions, self-oriented goals, organizational goals	Presents two novel/ill-defined military leadership problems. Respondents asked to indicate most important problem to address, key information needed to resolve the problem, and other problems that would need to be considered.	Three judges read through reponses to all qustions and rate responses for key solution characteristics. Scores obtained by averaging judges' ratings across the two problems.
Social Judgment	Self-reflectivity, self-objectivity, judgment under uncertainty, solution fit, systems perception, systems commitment	Presents two scenarios of organizational problems. Respondents asked to indicate why situation occurred, central mistake made by person in situation, and what respondent would have done in this situation.	Three judges read through responses to all questions and rate on social judgment dimensions for each problem. Scores obtained by averaging judges' rating acorss the two problems.
Creative Thinking	Realism of consequences, complexity, time span, positive and negative consequences, principle-based, positive outcome sensitivity, negative outcome sensitivty	Presents a string of "what if" events. Respondents asked to list the likely consequences or the outcomes of this event.	Three judges read through respoonses to each "what if" event and rate each on leader-based creative thinking characteristics. Scores obtained by averaging judges' responses across all problems.
Leadership Expertise	Principle-based knowledge structures, organization, coherence of knowledge categories, consistency with existing leader activity taxonomy, and number of categories	Respondents presented with a list of leadership tasks. After reading through tasks, they are asked to create a set of categories and then assign tasks to those categories.	Number of categories is counted. Categories and task assignments reviewed by three judges who rate on all constructs. Scores obtained by averaging judges' ratings.

respect to the extent to which certain attributes of a skill or expertise were manifest in performance. The resulting interrater agreement coefficients ranged from .56 to .91, averaging .75. Evidence for the criterion-related validity of these scales was provided by Connelly, Gilbert, Zaccaro, Threlfall, Marks, and Mumford (2000).

In addition to the skill measures, two leadership criterion measures described by Zaccaro et al. (2000) are used in the present effort. The first measure was a self-report, career achievement record where officers were asked to report objective, verifiable accomplishments (e.g., medals won, awards received, etc.). Evidence of the reliability and the validity of this kind of objective career achievement record has been provided by Kilcullen (1993). Quality of problem solutions was used as the second criterion measure, where judges rated the overall quality and originality of solutions to novel, ill-defined military problems.

A third leadership criterion not described in Zaccaro et al. (this issue) used a variation of Hough's (1984) behavioral consistency technique. Officers were asked to think about their performance during the last year and provide written "best performance" examples for four general dimensions of leadership behavior identified by Fleishman, Mumford, Zaccaro, Levin, Korotkin, and Hein (1991). Four doctoral candidate judges evaluated the quality of leadership manifest in these incidents on a five-point scale. The mean interrater agreement across these dimensions was .94. Average ratings across all four dimensions provided the overall score.

Career Development Measures

In addition to these skill and leadership criterion measures, officers were asked to complete two inventories examining different kinds of developmental influences. The first inventory was intended to assess career development experiences that might influence skill acquisition. This inventory contained 52 background data items generated based on (1) interviews with senior Army officers concerning significant developmental experiences and (2) a review of the literature examining the kind of experiences contributing to the development of high-level talent (Barron & Harrington, 1981; Simonton, 1990; Walberg & Stariha, 1992).

A subsequent principal components analysis of these items indicated that a nine-factor solution, accounting for 30.7% of the total item variance, provided the most appropriate summarization of these items. The factors identified in this analysis were labeled (1) Development (e.g., training at home, counseling subordinates, learning new things); (2) Basic Technical Training (e.g., completed basic advance course, specialist course, branch qualification); (3) Advanced Professional Training (e.g., completed staff college, college, senior service college); (4) Networking (e.g., discusses work problems with peers, has close friends at work); (5) Enculturation (e.g., positions or views similar to those of peers); (6) Traditional Army Background (e.g., attended officer candidates school); (7) Career Intellectual Involvement (e.g., read military history issues, public policy issues); (8) Special Tasking (e.g., had special assignments in the last five years); and (9) Senior Officer Mentoring (e.g., had exposure to senior officers, participated in discussions with senior officers).

The second career development measure was intended to capture the aspects of job assignments which might influence the acquisition of leadership skills. Here,

Table 2. Assignment Characteristics

1. Combat
2. Interpersonal problem solution
3. Negotiation
4. Monitoring/developing others
5. Exposure to role models
6. Communication
7. Team experience
8. Discretionary decision making
9. Long-term strategic planning
10. Problems with multiple components
11. Novel, ill-defined problems
12. Concrete standard problems
13. Autonomy
14. Dynamic/diverse job
15. Boundary spanning
16. Risk taking
17. Scarce resources
18. Control of resources
19. Technical responsibility
20. Supervisory responsibility
21. Temporal stress
22. Cooperative climates
23. Cultural diversity
24. Self development
25. Feedback
26. Training opportunities
27. Administration
28. Investigation
29. System maintenance

officers were asked to provide a written three-paragraph description of the assignments that proved most beneficial over the last five years of their Army careers. In describing these assignments, they were asked to describe (1) their major duties on this assignment, (2) the most significant aspects of these duties, (3) the kind of problems they worked on, and (4) how they went about solving these problems. A sample of 50 descriptions was then reviewed by three psychologists familiar with data from the military and the career development literature to formulate a content coding scheme based on key assignment features. Table 2 lists the 29 content coding categories that emerged from this analysis.

Four judges reviewed the assignments descriptions provided by officers. After reading through the material, judges were asked to decide whether a particular type of assignment characteristic was mentioned or not. Dichotomous ratings were to be made only if the judges felt that the descriptive material provided sufficient information to assess the presence or absence of certain assignment characteristics. The average interrater agreement obtained for these ratings was .71.

Control Analyses

Prior to conducting the central analyses intended to examine address the goals of this study, a series of control analyses were conducted. The first of these analyses

was intended to examine whether cohort effects, or changes in the types of officers entering the Army, might account for any differences observed in skills across junior, mid-level, and senior officer groups (Baltes & Schaie, 1976; Cook & Campbell, 1979). Here, the ability, personality, and motivational measures were used to construct a set of subgroups describing the typical profiles of officer characteristics observed at the time of entry into the organization. Subsequently, an attempt was made to slot senior officers into these junior officers subgroups using a *K*-means analysis. It was found that 88% of the senior officers could be unanimously assigned to a junior officer subgroup ($p > 80$—see Mumford, Zaccaro, Johnson, Diana, Gilbert, & Threlfall, 2000). Although this finding does not rule out cohort-by-time interactions, it does suggest that simple cohort effects attributable to changes in recruitment policies could not easily account for any developmental efforts obtained in the present study.

The second set of analyses was intended to assess whether spurious effects might arise from changes in the structure of the skill measures (Hertzog, 1989). Here, the variance covariance matrices obtained in the junior, mid-level, and senior officer groups were compared using a LISREL VI analysis of correlation structures. In this analysis, it was found that the structure of relationships among the component scales obtained for each skill measure was constant across groups. As a result, the correlation patterns and meaning of the skill measures appear to be quite consistent across groups. Thus, changes in the structure of the skill measures across groups does not appear to be a plausible alternative explanation for observed developmental effects.

A third alternative explanation for observed developmental effects involves the Army 'up or out' policy. In other words, development might be attributed to the selective survival of certain individuals. Of particular concern in this program is whether this policy results in a situation where the selective retention of more intelligent individuals produces higher scores on the various skill measures. To provide some preliminary evidence for this, junior, mid-level, and senior officers were compared on a standard measure of general intelligence (verbal reasoning) using analysis of variance (ANOVA) contrasts. Junior officers ($M = 23.75$, $SD = 6.25$) differed significantly from mid-level officers ($M = 24.78$, $SD = 5.00$; t (2,1462) $= 2.76$, $p < .01$). However, mid-level officers did not differ significantly from senior officers ($M = 25.83$, $SD = 5.08$). Given that the difference between junior and mid-level officers reflects roughly one-fifth of a standard deviation, it is questionable whether there is any practical difference in intelligence. From this analysis, it appears that the selective survival of more intelligent officers does not provide an overwhelming threat to the validity of our conclusions. This finding is consistent with the results obtained in the subgrouping analysis described above.

Developmental Analyses

Once these control analyses had been completed, analyses to assess developmental changes in the various leadership skills were conducted. Initially, means and standard deviations of each component scale in the five measures of knowledge and skill were obtained for the three officer groups. Mean differences were tested using a series of ANOVAs, contrasting less experienced with more experienced groups. Variance differences were tested using Levene's procedure.

In the next set of analyses, an attempt was made to assess differences in skill levels at different points in leaders' careers. To assess differences in skills across organizational levels, a series of discriminant analyses were completed where the scales included in each skill measure were used to account for differences between less experienced and more experienced officers. These analyses contrasted high-performing junior officers, as defined by a within-group median split on the career achievement scale, with all mid-level officers. Likewise, high-performing mid-level officers were contrasted with all senior officers. Use of high performers in each analysis controlled for the promotional criteria reflected in the career achievement measure. This was intended to minimize the effects of the up-or-out policy on skill and knowledge scores.

The discriminant functions obtained in this analysis indicate the skills associated with development at certain points in leaders' careers. In the next set of analyses, the discriminant function scores were correlated with (1) scores on the critical incidents and solution quality criteria, (2) scores on the career development factors, and (3) scores on the job assignments measure. These analyses were intended to provide some initial evidence indicating whether differences in skill development across organizational levels were related to career development events, job assignments and training.

RESULTS

Descriptive Statistics

Table 3 presents the means, standard deviations, and ANOVA contrasts for junior, mid-level, and senior officers on each scale included in the criterion, knowledge and skill measures. As might be expected, given the fact that manifest leader achievement depends on time and opportunity, scores on the leader achievement measure increase significantly with grade level across groups of junior ($M = 6.37$, $SD = 3.80$), mid-level ($M = 11.75$, $SD = 2.44$), and senior ($M = 13.95$, $SD = 2.66$) officers. Critical incidents scores for senior officers ($M = 3.20$; $SD = .44$) were significantly higher than mid-level ($M = 3.00$, $SD = .47$) and junior officers; however, junior and mid-level officers did not differ on this measure. Increases in solution quality were obtained on the unstructured military problems with more senior officers producing higher quality solutions ($M = 3.38$, $SD = .53$) than mid-level officers ($M = 2.91$, $SD = .54$) who, in turn, produce higher quality solutions than junior officers ($M = 2.50$, $SD = .56$).

One potential explanation for these increases in the leadership criteria is the acquisition of expertise. In examining the findings obtained for the leader knowledge measure it is clear that complexity of knowledge increases from junior officers to mid-level officers. This finding is consistent with the earlier observations of Streufort and Streufort (1978). Experienced officers evidence the coherent, organized, principle-based knowledge structures characteristic of experts, and formulated structures consistent with a theoretically-based model of leader behavior. For example, mid-level officers are significantly more likely to use principle-based organizations of leadership tasks than junior officers, while senior officers are significantly more likely to use principle-based organizations than mid-level officers. It is not just

Table 3. Means and Standard Deviations for Skill Measures

	Junior			*Mid-Level*			*Senior*	
	M	SD	t_{jm}	M	SD	t_{ms}	M	SD
Performance								
Leader achievement	6.37	3.80	27.06**	11.75	2.44	7.47**	13.95	2.66
Critical incidents	2.94	0.62	0.69	3.00	0.47	2.79**	3.20	0.44
Solution quality	2.50	0.56	9.8**	2.91	0.54	8.10**	3.38	0.53
Leadership Expertise								
Organization	2.83	0.83	3.53**	3.01	0.64	5.39**	3.59	0.71
Principles	2.28	0.65	6.68**	2.65	0.62	4.77**	3.04	0.61
Coherence	2.76	0.70	3.31**	2.95	0.53	5.33**	3.40	0.56
Theoretical similarity	2.34	0.92	2.97**	2.56	0.79	2.28*	2.82	0.91
Number	3.03	0.76	4.54**	3.32	0.70	0.46	3.37	0.83
Complex Problem Solving (Cued)								
Problem construction	2.47	0.53	6.87**	2.78	0.52	7.71**	3.32	0.62
Information encoding	2.59	0.62	5.41**	2.88	0.65	7.57**	3.49	0.67
Category search	2.24	0.74	4.68**	2.54	0.76	6.33**	3.15	0.81
Category fit	2.55	0.60	4.83**	2.81	0.60	8.34**	3.52	0.62
Category combination	2.26	0.64	5.29**	2.61	0.73	6.41**	3.26	0.82
Idea evaluation	2.26	0.56	5.34**	2.57	0.64	7.32**	3.23	0.76
Implementation planning	1.97	0.69	1.29	2.08	0.66	4.23**	2.68	0.94
Monitoring	2.17	0.64	1.18	2.26	0.66	5.41**	2.98	0.86
Solution Construction								
Attention to restrictions	2.63	0.55	6.93**	2.94	0.52	5.55**	3.31	0.46
Time span	2.56	0.47	8.79**	2.89	0.43	5.61**	3.22	0.39
Self goals	1.99	0.41	1.11	2.03	0.37	−0.40	2.01	0.30
Organizational goals	3.07	0.50	8.27**	3.39	0.37	3.88**	3.62	0.39
Creative Thinking								
Realism	2.81	0.57	13.45**	3.24	0.44	4.22**	3.43	0.41
Time span	2.07	0.45	10.88**	2.35	0.42	9.29**	2.70	0.34
Negative consequences	1.18	0.29	1.26	1.21	0.28	1.86	1.26	0.28
Positive consequences	0.95	0.22	0.92	0.96	0.17	0.19	0.96	0.16
Complexity	2.17	0.45	15.70**	2.56	0.39	7.82**	2.85	0.36
Abstraction	1.99	0.43	17.18**	2.42	0.41	12.02**	2.88	0.42
Social Judgment								
Reflection	2.64	0.60	5.81**	2.92	0.53	6.93**	3.43	0.58
Objectivity	2.50	0.58	6.19**	2.78	0.49	6.24**	3.22	0.58
Judgment	2.54	0.63	6.48**	2.87	0.58	7.41**	3.44	0.63
Systems perception	2.44	0.63	10.97**	2.99	0.53	5.76**	3.41	0.62
Systems commitment	2.56	0.65	8.87**	3.01	0.56	5.43**	3.44	0.62
Solution fit	2.67	0.60	6.49**	2.97	0.51	6.50**	3.57	0.59

Notes: * $p < 0.05$; ** $p < .01$.

complexity, but rather frameworks for organizing complexity that characterize more senior leaders. These changes in means are not necessarily associated with changes in variance. However, in contrasting junior and mid-level officers, a significant difference in variance ($p < .05$) is observed on our measures of organization, coherence, and theoretical similarity.

Not only are there increases in expertise, there are increases in the skills needed to work with this knowledge in solving novel, ill-defined leadership problems. On

the measure examining the application of complex problem-solving skills (cued), mid-level officers perform significantly better than junior officers on scales examining aspects of solution production, including problem construction, encoding, category search, category fit, category combination, and idea evaluation. Senior officers perform significantly better than mid-level officers, not only on the production scales, but also on the implementation, planning, and monitoring measures. This finding suggests that officers with more experience are better at translating new ideas into action, an observation consistent with the increased ($p < .01$) variability observed among senior officers on these scales.

The social judgment scenarios, solution construction scenarios, and creative thinking measures all examined various skills needed to implement solutions to leadership problems in organizational settings. More personally-oriented scales in the military scenarios and consequences measures, such as a focus on personal goals, positive consequences, and negative consequences, did not distinguish among junior, mid-level, and senior officers. However, more objective types of scales related to implementing solutions in complex, organizational systems showed increases from junior to mid-level and senior positions. The solution construction scenarios measure expressions of these systems skills in the domain of Army leadership. Here, attention to restrictions, solution time frames, and convergence of solutions with organizational goals display significant increases when contrasting senior officers with mid-level and junior officers. The creative thinking scales examine similar attributes outside of a military context. Here again, senior leaders evidence a significantly longer time span than do mid-level officers when appraising the implications of novel situations. Mid-level officers evidence significantly longer time frame than do junior officers. More experienced officers also identify consequences of novel events with significantly greater realism, complexity, and abstraction. Thus, the increases in systems skills apparently evidence some generality.

To implement solutions in a complex system, leaders must also be able to go outside organizational structures to generate social judgment and perspective taking. The social judgment scenarios attempt to assess skills relevant to social judgment and perspective taking by using a set of general business problems intended to elicit these attributes. Across the self-reflection, objectivity, judgment, systems perception, systems commitment, and solution fit scales, senior officers score significantly higher than mid-level officers, who, in turn, score significantly higher than junior officers. The objectivity, systems perception, systems commitment, and solution fit scales also evidenced a slight, but significant decrease in variance when comparing junior and mid-level officers. Although the reason for these effects is somewhat obscure, they may mirror the normalization effects observed on the knowledge measure, given Smith and Baltes (1990) observations of the positive relationships between related types of social judgment variables and expertise. These findings, taken as a whole, provide some support for our argument that knowledge, problem solving skills, and social judgment skills increase with experience.

Discriminant Analyses

The preceding findings do not provide a great deal of information about how knowledge and skills change from lower- to upper-level grades. Initial evidence along these lines is provided in the discriminant analyses presented in Table 4.

Table 4. Discriminant Function Analyses Results for Skill Measures

	Junior to Mid-Level	*Mid-Level to Senior*
		$\chi^2(8) = 34.20, p < 0.001$
Complex Problem Solving (Cued)	NS	Canonical $R = 0.62$
Problem construction	—	0.56
Information encoding		0.52
Category search	—	0.34
Category fit	—	0.76
Category combination	—	0.63
Idea evaluation	—	0.56
Implementation planning	—	0.45
Monitoring	—	0.38
	$\chi^2(5) = 52.30, p < 0.001$	$\chi^2(5) = 44.10, p < 0.001$
Leadership Expertise	Canonical $R = 0.36$	Canonical $R = 0.45$
Organization	0.20	0.71
Principles	0.65	0.60
Coherence	0.25	0.77
Theoretical similarity	0.26	0.32
Number	0.57	0.02
	$\chi^2(4) = 45.00, p < 0.001$	$\chi^2(4) = 26.40, p < 0.001$
Solution Construction	Canonical $R = 0.31$	Canonical $R = 0.35$
Attention to restrictions	0.65	0.87
Time span	0.88	0.93
Self goals	0.00	0.01
Organizational goals	0.90	0.71
	$\chi^2(6) = 214.10, p < 0.001$	$\chi^2(6) = 104.50, p < 0.001$
Creative Thinking	Canonical $R = 0.45$	Canonical $R = 0.47$
Realism	0.66	0.42
Time span	0.53	0.82
Negative consequences	0.03	0.17
Positive consequences	0.02	0.04
Complexity	0.77	0.69
Abstraction	0.90	0.95
	$\chi^2(6) = 106.80, p < 0.001$	$\chi^2(6) = 57.10, p < 0.001$
Social Judgment	Canonical $R = 0.45$	Canonical $R = 0.49$
Reflection	0.32	0.72
Objectivity	0.32	0.63
Judgment	0.41	0.80
Systems perception	0.75	0.64
Systems commitment	0.65	0.63
Solution fit	0.38	0.93

Notes: NS = not significant.

Table 4 presents the chi-square values and canonical correlations obtained in these analyses, along with the loadings of the skill scales on the relevant functions. As may be seen, scales examining problem-solving processes failed to yield significant effects when used to discriminate high-performing junior officers from mid-level officers. Apparently, the significant means obtained in contrasting officer groups reflect sample characteristics rather than skill development. However, in contrasting high-performing mid-level officers to senior officers, a significant ($\chi^2 = 34.2, p < .001$) function was obtained yielding a canonical correlation of .62. Inspec-

tion of the standardized group function means indicated some increase in problem-solving skills in comparing mid-level ($M = -.69$) and senior ($M = .91$) leaders. The scale loadings indicate that these increases are most strongly related to having better complex problem-solving skills (Mumford, Baughman, Supinski, Costanza, & Threlfall, 1993).

This finding is hardly surprising when it is recognized that effective application of complex problem-solving skills depends on prior acquisition of requisite expertise. Elements of expertise develop early in leaders' careers as indicated by the significant discriminant function ($\chi^2(5) = 52.3$, $p < .001$) obtained in contrasting high-performing junior officers ($M = -.37$) with mid-level officers ($M = .40$). The principles ($r = .65$) and complexity ($r = .57$) scales have the highest loadings of the leader expertise which yield a canonical correlation of .36. Although the acquisition of principles is crucial at lower and mid-levels, true expertise also requires organized principle-based structures, which are seen at the senior levels. Accordingly, the significant function ($\chi^2(5) = 44.1$, $p < .001$) in contrasting high-performing mid-level officers ($M = -.44$) with senior officers ($M = .52$), coherence ($r = .77$), organization ($r = .71$), and principles ($r = .60$) shows increases across groups. This function, yielding a canonical correlation of .45, suggests that increases in the application of creative thinking skills to leadership problems occurs along with the acquisition of relevant expertise.

Expertise and complex problem-solving skills alone are not sufficient for effective organizational leadership (Mumford et al., this issue). Leaders must also be able to revise and implement solutions, while taking into account the demands of the organization. The solution construction scenarios provide a domain-specific measure of these skills while the creative thinking exercise provides a more general measure of these skills. In contrasting high-performing junior officers with mid-level officers, both the solution construction ($\chi^2(4) = 45, p < .001$) and creative thinking ($\chi^2(6) = 214.1$, $p < .001$) scales significantly discriminate these groups, yielding canonical correlations of .31 and .45, respectively. The resulting function means indicate increases in solution construction skills ($M = -.28$ versus $M = .37$) and creative thinking skills ($M = -.44$ versus $M = .58$). All solution construction scales discriminated the officer groups, except self-oriented goals. Creative thinking scales that discriminated officer groups include attention to organizational goals, attention to restrictions, time span, realism, complexity, and abstraction increase by organizational level.

In contrasting high-performing mid-level officers and senior officers on these scales, a similar pattern of findings emerges. Again, canonical correlations of .35 and .47 are significant for both the solution construction skills ($\chi^2(4) = 26.4$, $p < .001$) and the creative thinking skills ($\chi^2(6) = 104.5, p < .001$). Here the standardized function means again indicate increases in skills on the solution construction measure ($M = -.33$ versus $M = .42$) and creative thinking measure ($M = -.47$ versus $M = .59$) with attention to organizational goals, attention to restrictions, time span, realism, complexity, and abstraction all being associated with increases across organizational level.

The scenarios examining social judgment also indicate changes across organizational grade for all the levels under consideration. The canonical correlation of .45

is significant (χ^2 (6) = 106.8, $p < .001$) in contrasting high-performing junior officers ($M = -.44$) with mid-level officers ($M = .57$), as well as the canonical correlation of .49 (χ^2 (6) = 57.1 $p < .001$) in contrasting high-performing mid-level officers ($M = -.50$) with senior officers ($M = .42$). The most striking findings emerging in this analysis, however, are the loadings of the scales that demonstrate increases in organizational level. In the junior to mid-level contrast, systems perception ($r = .75$), and systems commitment ($r = .65$) display the largest loadings. However, in the mid-level to senior contrast, solution fit ($r = .73$), judgment ($r = .80$), reflection ($r = .72$), objectivity ($r = .63$), systems perception ($r = .64$), and systems commitment ($r = .63$) also have sizable loadings. This pattern of findings suggests, in accordance with our model of leader development, that awareness of and commitment to social systems is present in lower level officers, while additional characteristics such as a more balanced, mature approach to organizational problems are present in more mature and experienced officers.

Career Development

The discriminant functions indicate increases in leadership skills even when factors contributing to promotion are taken into account. The functions reflect skill increases across early, middle, and later portions of leaders' careers. As a result, the discriminant function scores derived from these analyses provide a particularly appropriate index for examining the influences on, and consequences of, skill increases. Table 5 presents the correlations of these discriminant function scores with the critical incident and solution quality criteria. This table also presents the correlations of the assignment characteristics ratings with the discriminant function scores.

One would expect increases in leadership skills across organizational levels to be related to indices of leader effectiveness such as those reflected in the critical incidents. As may be seen, critical incident performance is significantly and positively related to scores on the discriminant functions as obtained by contrasting high-performing junior and mid-level officers (avg. $r = .19$). A similar pattern of relationships emerges for the discriminant functions contrasting high-performing mid-level offices with senior officers. Here, all of the discriminant functions yield significant ($p < .001$) correlations with incident performance (avg. $r = .19$), roughly equivalent to those obtained in the earlier period.

The design used in our initial data collection prohibits examining the relationship between complex problem-solving skill increases and solution quality. Solution quality correlations could, however, be obtained with the function scores for the other constructed response measures. Solution quality is significantly related ($p < .001$) to increases in social judgment (avg. $r = .35$); systems skills, as measured by the creative thinking measure (avg. $r = .48$); and leader expertise (avg. $r = .18$). Thus, is appears that skill increases across organizational level are indeed related to both improved performance and the capacity to solve the kind of novel, ill-defined organizational problems that are critical determinants of effective leader performance.

If skill increases are related to problem solving and leader performance, a new

Table 5. Correlations of Discriminant Function Change Scores with Performance and Assignments

	Junior to Mid-Level					*Mid-Level to Senior*				
	Complex Problem Solving	*Social Judgment*	*Solution Construction*	*Creative Thinking*	*Leader Expertise*	*Complex Problem Solving*	*Social Judgment*	*Solution Construction*	*Creative Thinking*	*Leader Expertise*
Performance										
Critical incidents	0.21**	0.14**	0.18**	0.28**	0.16**	0.19**	0.18**	0.20**	0.26**	0.14**
Solution quality	—	0.34**	−0.04	0.47**	0.23**	—	0.36**	−0.04	0.49**	0.12**
Assignments										
Combat	−0.05	0.11*	0.01	0.01	−0.02	−0.03	0.08	0.03	0.01	0.13*
Interpersonal problem solving	−0.06	−0.02	0.00	−0.05	−0.06	−0.05	−0.01	0.01	−0.08*	−0.08
Negotiation	0.09	0.02	0.02	0.04	−0.01	0.03	0.09	0.07	0.06	0.06
Monitor/develop others	0.24**	0.10*	0.20**	0.10**	0.07	0.21**	0.15**	0.20**	0.09*	0.02
Exposure to role models	−0.04	0.07	0.03	−0.06	−0.02	−0.02	−0.05	0.06	−0.04	−0.03
Communication	0.06	0.15**	0.14**	0.13**	0.07	0.10	0.17**	0.12*	0.11**	0.05
Team experience	0.10	0.13**	0.16**	0.04	0.04	0.09	0.10	0.16**	0.05	0.03
Discretionary decision making	0.25**	0.13**	0.25**	0.12**	0.04	0.24**	0.09	0.26**	0.10**	0.00
Long-term strat. plan.	0.16	0.10*	0.15**	0.23**	0.13*	0.26**	0.15**	0.19**	0.26**	0.22**
Problems w/mult. compnts.	0.31**	0.14**	0.21**	0.10**	0.09	0.29**	0.12**	0.21**	0.15**	0.10
Novel, ill-defined probs.	0.26**	0.07	0.16**	0.15**	0.09	0.27**	0.14**	0.20**	0.17**	0.19**
Concrete standard problems	−0.22**	−0.07	−0.13**	−0.14**	−0.03	−0.12	0.03	−0.07	−0.12**	−0.05
Autonomy	0.26**	0.10*	0.26**	0.12**	0.15**	0.20**	0.17**	0.24**	0.09**	0.12*
Dynamic/diverse job	0.18*	0.00	0.16**	0.08*	0.03**	0.18*	0.18**	0.19**	0.10**	0.09
Boundary spanning	0.32**	0.05	0.14**	0.12**	0.04	0.29**	0.14**	0.19**	0.14**	0.10**
Risk taking	−0.05	0.03**	0.04**	0.01**	−0.04	0.00**	0.07**	0.05**	0.01	0.15**
Scarce resources	0.11	0.12	0.10*	0.06	−0.04	0.05	0.01	0.17**	0.06	0.04
Control of resources	0.13	0.10*	0.13**	0.07	0.11*	0.16	0.03	0.14**	0.04	0.15
Technical responsibility	−0.02	0.04	0.05	0.06	0.05	−0.05	0.03	0.09	0.05	−0.02

(continued)

Table 5. (Continued)

	Junior to Mid-Level					*Mid-Level to Senior*				
	Complex Problem Solving	*Social Judgment*	*Solution Construction*	*Creative Thinking*	*Leader Expertise*	*Complex Problem Solving*	*Social Judgment*	*Solution Construction*	*Creative Thinking*	*Leader Expertise*
Supvsr. responsibility	−0.07	0.13**	0.01	0.04	0.12*	−0.02	0.08	0.04	−0.01	−0.03
Temporal stress	0.05	0.05	−0.05	−0.05	−0.07	−0.09	0.07	−0.06	−0.05	−0.01
Cooperative climates	0.06	0.01	−0.01	−0.09	−0.06	−0.02	0.11*	0.04	−0.07	0.00
Cultral diversity	0.09	0.03	−0.02	0.05	−0.05	0.09	0.11*	0.06	0.05	0.07
Self development	0.17*	0.05	0.13**	0.11**	−0.01	0.21**	0.06	0.14**	0.10	0.03
Feedback	0.07	0.05	0.16**	0.05	−0.08	0.10	0.03	0.12*	0.06	−0.06
Training opportunities	0.00	−0.02	0.02	−0.02	−0.01	0.06	0.08	0.01	0.00	0.03
Administration	0.07	0.00	0.07	0.08*	0.04	0.08	0.14**	0.10*	0.08*	0.11*
Investigation	0.16	0.07	0.02	−0.02	0.06	0.07	−0.01	0.01	0.01	0.04
System maintenance	0.18*	0.09	0.07	0.05	0.04	0.24**	0.16**	0.07	0.09**	0.14**

Notes: $*p < 0.05$; $**p < 0.01$.

question arises: What kind of experiences are likely to contribute to the development of leadership skills at different points in leaders' careers? In our earlier discussion of skill acquisition, we argued that certain kinds of job assignments might influence skill increases. Thus, some initial evidence along these lines is provided by the correlations between ratings of assignment characteristics and the discriminant functions. These correlations are also presented in Table 5.

Correlations between assignment characteristics and discriminant functions indicating skill increases across grade were modest. This finding, however, is not especially surprising given that dichotomous assignment characteristics ratings represent single-item measures and that no single-item measure provides a fully adequate description of a beneficial assignment. Even considering this caveat, a number of assignment characteristics showed significant correlations with one or more discriminant functions. In keeping with the notion that teaching others is a good way to learn, assignments requiring leaders to develop others correlate with increases in problem-solving (avg. $r = .23$) and solution characteristics (avg. $r = .20$) across both the junior to mid-level and mid-level to senior periods. Along similar lines, it was not surprising that assignments calling for communication correlate with increases in social judgment (avg. $r = .15$) and solution characteristics skills (avg. $r = .10$).

Although these findings are of some interest, the most consistent effects across both organizational level shifts show positive correlations between exposure to complex, ill-defined organizational problems and increases in problem-solving and solution characteristics, and creative thinking skills across organizational levels. Higher function scores are associated with exposure to valued assignments such as (1) problems with multiple components, (2) long-term planning, (3) novel, ill-defined problems, (4) diverse experiences, (5) autonomy, and (6) boundary spanning.

Assignments are not the only type of developmental experience that might influence the acquisition of requisite leadership skills. Other potential developmental influences are examined in the career development inventory analyses. Table 6 presents correlations among the nine career development factors derived from the inventory and scores on the discriminant function scores obtained in contrasting high-performing junior officers with mid-level officers, and high-performing mid-level officers with more senior officers. Correlations for the first three factors tended to be significant, while correlations with the remaining factors tended to be non-significant. The first factor, developmental orientation, was also significantly related ($p < .05$) to increases across both organizational levels in complex problem-solving skills and solution characteristics skills. In moving from junior to mid-level positions, developmental orientation was also significantly related to increases in social judgment.

These relationships, however, are marginal when compared to the relationships obtained for the two training factors. The basic technical training factor shows significant correlations with skill increases from junior to mid-level positions for all of our measures of skills and expertise (avg. $r = .22$). Although basic technical training yields somewhat weaker relationships in accounting from mid-level to senior positions (avg. $r = .11$), this finding might be attributed to the diminished importance of technical skills in more complex leadership skills. Advanced profes-

Table 6. Discriminant Function Score Correlations with Career Development Factors

	Junior to Mid-Level					*Mid-Level to Senior*				
	Complex Problem Solving	*Social Judgment*	*Solution Construction*	*Creative Thinking*	*Leader Expertise*	*Complex Problem Solving*	*Social Judgment*	*Solution Construction*	*Creative Thinking*	*Leader Expertise*
Developmental Orientation	0.10*	0.09*	0.05	0.11**	−0.02	0.12**	0.05	0.07	0.12**	0.02
Basic Technical Training	0.10*	0.19**	0.27***	0.39**	0.19**	0.03	−0.01	0.20**	0.25**	0.06
Advanced Professional Training	0.17**	0.10*	0.16***	0.29**	0.08*	0.22**	0.21**	0.23**	0.39**	0.16**
Networking	0.09*	0.06	0.07	0.02	0.07	0.05	0.07	0.04	0.04	0.06
Enculturation	−0.01	0.03	−0.02	0.02	0.05	0.02	−0.01	−0.02	0.01	0.02
Regular Army Background	−0.01	−0.03	0.01	−0.03	−0.05	−0.11	−0.04	−0.01	−0.03	−0.12
Career Intellectual Involvement	−0.04	−0.07	0.03	0.05	−0.05	0.01	−0.04	−0.03	0.05	−0.02
Special Tasking	0.05	0.11**	−0.05	0.03	−0.07	−0.02	0.06	−0.05	0.01	−0.07
Senior Officer Mentoring	0.03	0.01	0.07	0.07	−0.01	0.08	0.04	0.06	0.06	−0.11**

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

sional training was significant ($p < .001$), with increases in knowledge and skills as leaders moved from mid-level to more senior positions ($r = .28$) showing somewhat weaker ($r = .16$) but significant effects ($p < .05$) on skill increases in moving from junior to mid-level positions. One implication that can be drawn from this is that well-designed training may contribute to the development of leadership skills.

DISCUSSION

Before proceeding to the broader implications of our findings, certain limitations should be noted. To begin, our findings were obtained in a sample of leaders drawn from one organization, the Army. Thus, some caution is called for in generalizing these findings to other settings. Clearly, training was related to increases in requisite leadership skills across officer groups at different phases of their careers. It should be recognized, however, that Army training programs are usually well-designed, involving intense course work, sometimes over a period as long as nine months. Thus, it is open to question whether these findings can be used as an omnibus justification for the value of leadership development programs, although they may well say something about the value of the systematic progressive approach employed by the Army.

To generalize these findings, the particular sampling design in use should also be considered. Ideally, attempts to examine development should be based on a cohort sequential design. Any study employing a purely longitudinal approach or a purely cross-sectional approach (such as the one employed here) suffers from cohort problems (Baltes & Schaie, 1976). For example, the generality of findings emerging from longitudinal design are open to question unless multiple cohorts have been studied. The generality and validity of findings obtained in cross-sectional studies can be questioned based on cohort effects, selective survival, or changes in available developmental opportunities. Although these effects cannot be entirely ruled out here, the results of the control analyses presented earlier suggest that cohort effects and selective survival are not unduly influencing the results across the groups compared in this study.

Even bearing these caveats in mind, we believe that the present study has some important implications for studies of leadership development. The theory of effective organizational leadership proposed by Mumford et al. (2000) holds that leader performance ultimately depends on the person's ability to solve novel, ill-defined organizational problems. Quality of responses or solutions to these problems, moreover, may depend on whether the individual possesses the requisite knowledge and a more complex set of skills. One key proposition of this kind of skills-based model of leadership is that skills should provide strong support for this general proposition. In our initial analyses, higher scores on measures of creative problem-solving skills, social judgment, systems skills, and leadership expertise were observed as leaders moved into more responsible senior positions. Of greater importance, however, were the effects observed in the discriminant analyses. Results obtained in these analyses (with one exception: problem-solving skills from junior to mid-level posi-

tions) indicated increases in levels of requisite leadership skills from junior to mid-level to senior positions. Moreover, the solution construction and creative thinking measures indicated that these effects with regard to systems skills appeared to evidence some generality.

Taken as a whole, these findings provide some initial support for the theory proposed by Mumford, Zaccaro et al. (2000) in three areas. First, the measures in use evidenced increases in expertise and skills across grade levels. Second, different aspects of expertise and different skills appear to be relevant for lower and upper level leaders. Third, more senior leadership positions apparently require higher levels of skills in general. In addition, one would expect that as leaders acquire capability, they will exhibit better performance. In fact, increases in leader expertise, problem-solving skills, social judgment, and systems skills, appear to be accompanied by improved critical incident performance and higher quality solutions to ill-defined military leadership problems.

Not only does the skills-based model of leader development imply development in skills, it implies that this development occurs in a progressive, systematic fashion. More specifically, leaders must initially acquire basic concepts and principles. These concepts and principles make it possible for leaders to apply and begin to develop creative problem-solving skills which are subsequently integrated with the practical demands of implementing problem solutions within a complex organizational system. In fact, the results obtained in the present investigation provide some support for this model of leader development.

Mid-level leaders appeared to have more complex principle-based knowledge structures than junior level leaders. Because creative problem solving is contingent on the availability of such structures (Baughman & Mumford, 1995), only small increases were seen in the application of these skills. As the more coherent, organized principle-based structures characteristic of true expertise emerged (Anderson, 1993; Ericsson & Charness, 1994), creative problem-solving skills emerged, accompanied by a more pragmatic evaluation of solutions taking into account a longer time span. Thus, in broad terms, the patterns of skill increases observed in this study seem to conform to a skill or capacity-based model of leader development.

Although the general patterns of our findings imply support for a systematic, progressive model of leader development, one proviso should be noted. Certain systems skills, for example, realism and attention to restrictions, increased from junior to mid-level and from mid-level to senior positions. One potential explanation for this finding is that the increased levels of skills is contingent on experience and knowledge of the organization as opposed to more formal, expertise-based knowledge structures (Mumford & Gustafson, in press; Sternberg, Wagner, & Williams, 1995). Alternatively, organizational knowledge may interact with more formal knowledge structured in the acquisition and application of systems skills. In fact, the results obtained for our measure of systems skills provide some indirect support for this latter explanation.

This structured model of the development of leadership skills is of interest for practical as well as theoretical reasons. By understanding the structure of leader skill acquisition, it becomes possible to draw some general conclusions about the kinds of interventions likely to contribute to leader development. One noteworthy

direct application of this model of leader development is that assignments providing experience in solving complex organizational problems should contribute to skill development and performance, particularly in terms of requisite problem-solving and systems skills. The findings obtained in our analysis of assignment characteristics support this proposition, confirming the earlier findings of Bray et al. (1974) and McCauley et al. (1994).

The effect of these experiences, however, appears to depend on where the individual is within the developmental model outlined above. This point was illustrated in our finding that exposure to complex, organizational problems was not related to increases in social judgment in moving from junior to mid-level positions, although it was related to increases in social judgment in moving from mid-level to more senior positions, where leaders had the experience and maturity to interpret the implications of those experiences. Similarly, in accordance with our model of leader development, it was found that many experiences, such as those involved in administration and systems management, were related to skill increases across mid-level and senior positions. These findings, suggest that the outcomes of assignments and the features of assignments contributing to skill increases depend on the nature of the skills that are relevant at that point in leaders' careers. These assignments must be carefully designed to maximize their impact on leader development.

This point also is illustrated in our findings with respect to the impact of training on the increases in requisite leadership skills. Basic technical training was more strongly related to skill increases in moving from junior to mid-level positions while advanced professional training, which in the Army focuses on complex problem solving and the acquisition of more advanced principles (Zaccaro, 1996), was more strongly related to increases in requisite skills as leaders moved from mid-level to more senior positions. Thus, it appears that training interventions, like assignments, must be carefully tailored to current developmental needs if they are to have optimal effects on the acquisition of requisite skills and expertise.

CONCLUSION

The above observations about influences on skill acquisition bring us to a final comment. Some studies of leadership assume that interventions which promote skill increases at the point in leaders' careers can be readily generalized to all leaders, regardless of role. For example, it is not fashionable to assume that complex organizational structures will benefit all young leaders. The model of leadership simulating proposed action, and the findings obtained in the present study, tend to argue against this proposition, suggesting that simpler, structured exercises illustrating key principles will prove most beneficial. Hopefully, future studies will extend this model, showing how particular types of interventions interact with available skills. We believe that studies of this sort will serve not only to enhance our understanding of leader development, but will ultimately result in far more powerful systems for developing those skills leaders need to solve organizational problems in an ever more dynamic world.

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