CHAPTER 12

Linking Appraisals to Individual Development and Training

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With the rapid diffusion of technological innovations and the move toward a service economy, it is the quality of the people in the organization that gives companies the edge in a competitive marketplace. The development and retention of talent has become, for many companies, the key to survival. This will be particularly true in the difficult recruiting climate of the next decade, with a smaller labor pool of qualified employees in the prime age group, thirty to forty-five years old.

In light of continuous, rapid change, organizations are attempting to anticipate the skill requirements for future work and prepare their workforces. Effective performance in last year's environment may not be strongly predictive of next year's performance if the environment changes significantly. But it is often possible to evaluate, based on performance exhibited over the past year, the extent to which an employee already has the skills that will be required next year and to take action to ameliorate deficiencies before they affect future performance.

There is a growing appreciation for the "dual nature" of the performance appraisal process first identified by Meyer, Kay, and French (1965) so long ago. Not only must an effective appraisal accurately evaluate past performance as an equitable basis for rewards,
it should also guide future development, leverage existing strengths, and address skill deficiencies. This second function of the appraisal process is going to be more critical than ever in tomorrow’s workplace.

Yet against this increasing need to link appraisal and employee development processes stands an imposing set of practical and theoretical challenges. The practical challenges include:

- **Time.** Development is an ongoing process, not a once-a-year event—and today’s managers are already stretched.
- **Organizational support.** Managers operate in a business environment that emphasizes short-term performance. The payoff from development is not likely to have an impact on next-quarter profits.
- **Expertise.** Fairly sophisticated diagnostic and people-management skills are needed to provide constructive coaching—and these skills are not consistently considered in selecting managers.
- **Diagnostic tools.** Developmental planning requires appraisal processes that not only have sufficient construct validity but also have high levels of both inter- and intra-individual discriminability.
- **Developmental resources.** Training must be customized to address specific developmental needs in a cost-effective way.
- **HR planning.** Individual development must be linked to business strategy so that employees are prepared to meet tomorrow’s challenges.

Along with these practical challenges and directly influencing practice there is a set of theoretical challenges that must be successfully addressed. Important theoretical challenges include:

- Better understanding of skill dimensions so as to define the constructs we seek to appraise and develop more vigorously. Are we measuring knowledge, skill, the aptitude to perform effectively in the future, expressive style, or personality traits? Are these attributes different from the term *competency*? Do constructs have to be defined differently for appraisal and development purposes?
- Better understanding of processes for skill development so as to determine the employee’s stage of development for a particular skill. On what dimensions do novices and experts differ in the way they perform a task, which are fairly resistant to training?
- Developing an adequate performance feedback system so as to identify cost-effective developmental weaknesses.
- Applying a theory of instruction methodology for the prescription and right training at the right time.

To what extent have human resources and industrial-organizational psychologists taken up these challenges and established a conceptual framework for performance appraisal on one hand and employee training on the other? A review of the current research leads us to a number of conclusions:

- Nearly all performance feedback systems and personal development systems in use today are not those which we have tried to develop.
- There is a gap between the theoretical predictions and practice in the field of industrial-organizational psychology. More recently on appraisal feedback on performance appraisal (Carr) provides sound advice on measuring and feedback, appearing in *HR Magazine* (Carr).
- We believe there have been a number of areas of psychological understanding which can guide practice in leveraging appraisal processes in the workplace. Some of these are: the field of industrial and organizational psychology and the advances in the study of personality development, the advances with the measurement of personality development, the advances with the measurement of skills, and the advances with the measurement of developmental processes.
the way they perform a task? Which skills are malleable and which are fairly resistant to change in adult populations?

- Developing an adequate prescription based upon a diagnosis so as to identify cost-effective strategies for addressing developmental weaknesses.

- Applying a theory of instruction and effective instructional methodology for the prescription specified so as to deliver the right training at the right time to achieve maximum impact.

To what extent have human resource practitioners and industrial-organizational psychology researchers and theoreticians met these challenges and established an effective linkage between performance appraisal on one hand and employee development on the other? A review of the current state of appraisal practice and research leads us to a number of initial observations:

- Nearly all performance appraisals include professional and personal development sections but experience indicates that these items are rarely carefully tracked and followed to ensure implementation.

- There is a gap between research and practice. Within the field of industrial-organizational psychology, the focus has been almost exclusively on the validity or accuracy of appraisal ratings, and more recently on appraisal feedback. The most current textbook on performance appraisal (Cardy & Dobbins, 1994) thoroughly reviews the literature relevant to appraisal but includes nothing about how appraisal can be used to enhance employee skill. This is just as true of the practitioner literature. Typical of this phenomenon is a recent how-to article on performance management appearing in HR Magazine (Campbell & Garfinkel, 1996), which provides sound advice on measurement and feedback but makes no mention of subsequent development activity.

- We believe there have been significant advances in a number of areas of psychological research and theory that can help guide practice in leveraging appraisal as a tool to develop employees in the workplace. Some of these advances have occurred within the field of industrial and organizational psychology. Others have occurred in the study of personality and social psychology. In our view, the advances with the most far-reaching implications for appraisal and development have occurred in research conducted by
experimental psychologists working in such areas as cognition, skill acquisition, and motivation and emotion.

From our perspective, the process of linking performance appraisal to employee development can be conceptualized as a special case of the broader psychology of diagnosis, intervention, and change. In this case, change at the level of the individual employee consists of learning. This view places the issue of linking appraisals and development within a well-established theoretical and empirical literature on the mental process models that mediate human learning (Newell, 1990).

In this chapter, we will first describe several attempts in world-class organizations to use appraisal for development. We will then introduce a concept from experimental and instructional psychology, the mental process model, and discuss how this model can help us think more systematically about the link between appraisal and employee development. We will selectively review psychological research and theory relevant to the mental process model that can guide future appraisal research and practice. We will describe steps for the creation of a mental model–based developmental appraisal. We will provide samples of mental model–based competency models that can be used to develop performance appraisals that provide diagnostic information and guide curriculum decisions. Finally, we will evaluate recent trends in human resource practice in the area of developmental appraisal in light of the model and associated research findings.

The State of Practice

As we noted earlier, most organizations—certainly the larger and more HR-sophisticated organizations—have long (that is, since the early 1970s) had sections for diagnosing developmental needs and creating developmental plans in their regular performance appraisal forms. In a few of these organizations, those plans are reviewed the following year, and the extent to which developmental plans have been implemented actually affects the next year’s appraisal.

More recently, many of these larger organizations have embraced the strategy known as “competency modeling.” In some of these firms, an entire Competency Modeling Unit has been created whose sole function is to facilitate effective performance in specific job roles; they use software that can help organizations select employees from defined lists. Biannual counseling draws a thousand HR professionals together to review competency instead of KSAOs (knowledge, skills, and abilities). The result has certainly enhanced their perception of the quality of their work. A laudable outcome is that these firms are applying a consistent set of tools to develop and train.

Today, large organizations often have both performance-oriented appraisals and developmental appraisal processes. Examples from world-class organizations include:

- One electronics manufacturer’s developmental appraisal process. An analysis of this organization’s job content indicated that there were thirty-nine job dimensions. These dimensions were used to develop a job analysis. The job analysis resulted in a list of ten different job functions. The job functions were made to the content of job categories. Following the redesign of the job categories, new positions were created to support the newly redesigned jobs and assign work to the engineers.

- A technology sales organization developed a performance appraisal process that included the newly redesigned job categories and the targeted sales jobs. The appraisal process included a two-hour structured interview with a computer programmer, a telephone interview with each salesperson by
ated whose sole function is to define the dimensions required for effective performance in specific jobs or job families. Human resource magazines are filled with ads from vendors offering software that can help organizations identify relevant competencies from defined lists. Biannual conferences on competency modeling draw a thousand HR professionals or more. Using the term competency instead of KSAOs (knowledge, skills, abilities, and other characteristics) and the title competency modeler instead of job analyst has certainly enhanced the appeal—if not the substance—of this activity! A laudable outgrowth of this trend is that companies are applying a consistent set of competencies to select, appraise, and train.

Today, large organizations are increasingly conducting developmentally oriented appraisals outside the context of the regular supervisor appraisal process. What follows are a few current examples from world-class organizations:

- One electronics manufacturer recently installed a new developmental appraisal process as part of a reengineering initiative. An analysis of this organization’s product cycle time process indicated that there were thirty-nine steps and approval points in the process and ten different job functions involved. This process was adhered to by some five hundred professional engineers. Process reengineering resulted in fewer steps and approval points. Changes were made to the content of jobs, that is, their duties and component tasks. Following the redesign, different combinations of skills were required for the remaining and revised job functions. The organization developed a paper-and-pencil, developmentally focused performance appraisal process that obtained ratings on skill dimensions to arrive at a skill gap analysis to aid in placing people in the newly redesigned jobs and determining the training needs of the engineers.

- A technology sales organization needed to prepare its sales force for a more competitive marketplace. The organization developed and implemented a developmentally oriented diagnostic appraisal aimed at measuring the competency model defined for the targeted sales jobs. The appraisal was developed and delivered as a two-hour structured interview and administered over the telephone to each salesperson by a two-person team comprising the
interviewee’s manager and an outside assessor (a doctoral or master’s-level psychologist). The results were used by the manager and salesperson to create and implement an individual development plan that addressed the competency gaps identified by the appraisal. The final report contained courses and instructional suggestions for each of the areas of developmental need. Nearly two thousand salespeople participated in the diagnostic appraisal in a six-week period.

- A large computer company is preparing senior managers to champion organizational change into the next century. To appraise change leadership skill, the organization developed a four-hour simulation of a “year in the life” of a senior executive, with waves of restructuring and downsizing, emerging marketplace opportunities, and key staff additions and departures. In the course of the simulation, the executive’s change leadership skill is appraised by a team of external assessors. The diagnosis is far more detailed than the typical skill appraisal and includes an analysis of competency strength and weakness for each type of change situation encountered. Following a feedback session discussing the results of the leadership appraisal, the manager works closely with an outside coach, implementing a six-month skill development plan. Developmental activities include formal training, standard resources (books, tapes, videos), and on-the-job action learning (experimentation and reflection).

These examples illustrate that major organizations are recognizing the value of systematic appraisal as a tool in the more effective deployment and development of staff. These organizations are creating detailed, behaviorally based appraisal tools, using different methods (such as paper and pencil, interview, and roleplay), to focus specifically on gathering information for use in development. It is significant, though, that many of these organizations have created new processes for developmental appraisal outside the structure of the existing traditional, supervisor-driven performance appraisal system. This strategy may reflect an explicit or implicit recognition of the serious challenges in implementing an effective developmentally oriented appraisal process. In addition, even the best of these new processes make little use of emerging mental process models to guide the appraisal of factors underlying performance.

Diagnosis, Developmental Needs, and the Mental Process Model

In linking appraisal and developmental guidance, the diagnostic measurement tools used to guide decisions about an individual development plan. This is a fundamental shift that adds a new dimension to traditional talent management practices. Typically, developmental guidance is based on a traditional appraisal of an employee’s job performance and potential for promotion. The diagnostic assessment provides information about the employee’s underlying competencies and potential for growth, allowing for more effective and targeted development plans. This approach recognizes that performance is influenced by a range of factors, including the employee’s cognitive abilities, emotional intelligence, and other mental processes.

A mental process model is a comprehensive framework that identifies all the critical cognitive and behavioral processes that contribute to job performance. By understanding the interactions among these processes, organizations can develop strategies to improve performance. For example, rating scales for skill development, coaching, decision making, and other processes are designed to measure these competencies. Performance reviews are then used to assess whether an employee has performed well or poorly—and whether development interventions have added value.

The diagnosis of mental processes is critical to the development of effective development plans. It allows organizations to identify areas where an employee may be struggling and to develop targeted interventions to address those weaknesses. For example, an employee who struggles with interdepartmental collaboration may benefit from training in effective communication skills. By focusing on these underlying processes, organizations can create more effective development plans that address the specific needs of each employee, leading to improved performance and greater organizational success.
Diagnosis, Development, and the Mental Process Model

In linking appraisal and developmental planning, the appraisal is the diagnostic measurement event that must provide information to guide decisions about an individualized, prescriptive development plan. This is a fundamentally different application of appraisal than is usual in organizations. Diagnostic assessments are more commonly used in an educational setting such as an elementary or secondary school to make curricular decisions. The typical evaluation used in organizations focuses on a dichotomous decision: hire—no hire, promote—don’t promote, train—don’t train. Diagnostic assessment is more complex and extensive and must provide information that can be used to design an individualized development plan. Therefore these assessments are much more difficult to develop and validate and are critically dependent on the development and construct validity of a mental process model. Effective diagnostic assessment measures each of the components of the mental process model. However, appraisals used as a basis for employee development in organizations today are not based upon a well-articulated, validated mental process model.

A mental process model is a complete description of the psychological components of performance. A fully developed model specifies all the critical cognitive and social-emotional processes, and the interactions among these processes, that when functioning properly result in skilled performance. Most appraisals measure traitlike skill dimensions. For example, a typical appraisal contains rating scales for skill dimensions such as planning and organizing, coaching, decision making, and problem solving. But ratings on these competencies provide no information about why the ratee performed well or poorly—and these appraisals therefore have little diagnostic value. The assessment must answer the “why” question to be instructionally valuable.

For example, two employees with exactly the same poor rating for the problem-solving dimension may have very different developmental needs. One person may lack knowledge of problem-solving strategies and the other may lack self-confidence in problem-solving situations. On the positive side, the overall rating for the employees will indicate that neither can be depended upon to perform well on
problem-solving tasks at this time. In a selection situation, this alone is important and sufficient information. But for the purposes of creating a development plan, more is needed than an overall skill dimension rating. For development, the two employees’ assessments must diagnose different cognitive and emotional explanations for the overall performance to create developmental plans that reflect the true training and development needs. An appraisal designed on the basis of a properly specified mental process model will provide the necessary diagnostic information to create a development plan.

The notion of the mental process model has its origins in the work of Newell and Simon (1972), who laid out the framework for much of the research in cognitive psychology and information processing conducted during the following two decades. The “new look” stimulated by their work represented a shift from a trait- or abilities-based approach to human cognition to a process approach. This was a critical shift for those interested in diagnostic assessments and training. This shift, first apparent in research on human memory, yielded new information about mental process models and the components required for successful performance in different skill and knowledge domains.

Two important components of the mental process model are knowledge structures and executive control processes. Knowledge structures are the compiled facts, if-then relationships, taxonomies, rules, heuristics, techniques, and procedures that are learned through extensive direct experience and purposeful learning in a specific domain. Constructs similar or identical to the notion of knowledge structures include procedural knowledge, schema, scaffolding, scripts, tacit knowledge (Wagner & Sternberg, 1985), productions (Anderson, 1982), and thinking frames (Perkins, 1990). With learning, knowledge structures become larger, richer, and more interconnected. When addressing a problem, an experienced manager will analyze the situation more quickly, organize information into more sophisticated taxonomies, and solve the problem rapidly, often automatically, with little need for attentional resources. Understanding the knowledge structures underlying effective managerial problem-solving performance helps the appraiser more precisely identify existing weaknesses and suitable developmental strategies.

Executive control processes, by contrast, are the processes associated with prioritization of mental tasks, strategic planning, generation of appropriate knowledge structures, allocation of attentional resources, manipulation of affective states, allocation of attentional resources, goal-oriented behavior, and task maintenance. Researchers in recent years have focused on the components of mental process models that are most critical for effective performance. These models are derived from a variety of perspectives, including procedural and knowledge-based models, and are used to provide a framework for understanding the nature of performance and instruction. The model provides a basis for the practical design of training programs and the practical design of training programs that are linked to appraisal.

Development plans must be diagnostic assessment. If the diagnostic assessment is not correctly specified mental process models, the development plan will be misguided. A fully specified mental process model provides a basis for diagnostic assessment and for the creation of developmental plans. Thus a fully specified mental process model provides a basis for diagnostic assessment and for the creation of developmental plans. Such a diagnostic assessment and developmental plan. Such a diagnostic assessment and development plan. Such a diagnostic assessment and development plan.
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**Executive control processes**, by contrast, direct mental activity—the stream of consciousness. The functions of these processes include prioritization of mental tasks, searches of long-term memory for appropriate knowledge structures, selection of problem-solving strategies, allocation of attentional resources, goal setting, monitoring of progress toward goals, and start-task and stop-task decisions.

Researchers in recent years have learned much about the components of mental process models beyond knowledge structures and executive control processes (Brown, 1989; Newell, 1990). Constructs such as schema, heuristics, metacognitive strategies, attributional style, learning orientation, goal setting, and feedback, as well as of the impact of anxiety, worry, and stress on learning and performance, have been explored and their roles in theories of performance and instruction have been investigated. This literature provides useful direction for the development of appraisals and the practical design of training and development programs that are linked to appraisal.

Development plans must be based on the results of a valid diagnostic assessment. If the diagnostic assessment is based on an incorrectly specified mental process model, then the resulting development plan will be misguided. Figure 12.1 depicts the dependence of diagnostic assessment and of development planning on a mental process model. It illustrates that while the diagnostic assessment drives the creation of the development plan, they are both built on a valid mental process model.

Thus a fully specified mental process model is a complete description of the constructs or skill dimensions that are the targets of diagnostic assessment and the training. It contains a description of the cognitive and social-emotional components and constructs that make up the skill dimension as well as of the way they interact. A diagnostic assessment based upon a fully specified mental process model provides the information needed to create an individualized development plan. Such a diagnostic assessment can identify that (to return to the earlier example) the first employee's poor problem-solving performance was due to an incorrect knowledge structure and misdirected executive control processes, whereas the second performed poorly because problem-solving tasks created anxiety, which led to task-irrelevant mental ruminations that interfered with performance. Such an appraisal has actionable diagnostic value.
Figure 12.1. Importance of a Comprehensive, Valid Mental Process Model.

The Appraiser as Diagnostician

What are the responsibilities of the individual assigned to complete an appraisal if the goal of an appraisal is employee development? The requirements would include, of course, the valid differentiation among the employee’s levels of skill across a number of critical competencies. However, as we have been arguing, this degree of differentiation would not be sufficient to provide a valid diagnostic assessment. Like a physician reviewing a patient’s symptoms, the rater needs to identify the reasons underlying the employee’s current level of skill on each critical dimension. This requires the rater to rely on relevant information to triangulate on potential underlying cognitive, emotional, and physical causes in order to arrive at a reasonable diagnosis. Moreover, diagnostic appraisal further requires an indication of the developmental strategies to which the employee is most likely to respond, or whether the skill deficiency is treatable at all.

Indeed, there is evidence that less diagnostically detailed appraisals are actually more susceptible to rater bias. For example, a recent field study by Varma, DeNisi, and Peters (1996) revisited the old question of whether performance appraisal degree to which the appraiser’s liking does in fact influence performance appraisal forms may help. But what are the diagnostic assessments? The existing literature on guidance to organizations seeks the skills required for diagnostic and interrater discrimination. Some training also focuses on the model of the dimensions of difference (e.g. should be appraised and the number of published studies observational skills. Yet sophisticated skills are needed to generate the KSAOs required for diagnostic appraiser training practice and one.

Considering the Employee

There is an additional consideration: an assessment. Diagnostic appraisal is at the level of the employee. Proficiency of learning (Anderson, 1982) Anderson (1982) describes cognitive, procedural, and automatic stages of learning. The stage of learning is called the...
old question of whether performance appraisals are biased by the
degree to which the appraiser likes the employee. They found that
liking does in fact influence performance appraisals and that this
influence is significantly stronger on ratings of traits than on rat-
ings of specific task behaviors. Thus designing more discriminating
appraisal forms may help appraisers generate more objective
appraisals. But what are the appraiser skills that are needed for ef-
effective diagnosis?

The existing literature on rater training provides very limited
guidance to organizations seeking to define and develop the rater
skills required for diagnostic appraisals. Judging by the published
literature (see Woehr & Huffcutt, 1994, for a review), most rater
training consists of instruction on the evils of rating errors (halo,
leniency, central tendency). This may reduce the errors that are
the target of training at the expense of errors that are not stressed.
Some training also focuses on providing raters with a mental
model of the dimensions on which subordinate performance
should be appraised and the evaluation standards (frames of ref-
ence) to be applied in providing an overall assessment of these
dimensions. This enhances interrater consistency, though not in-
and forreree discrimi ratability. Very rarely, again judging by
the number of published studies, does training also seek to enhance
observational skills. Yet sophisticated observational and diagnostic
skills are needed to generate appraisals that are truly useful in de-
velopment. What is needed here is a more detailed job analysis of
the KSAOs required for diagnostic assessment as a guide to ap-
raiser training practice and research.

Considering the Employee’s Proficiency Level

There is an additional consideration when developing a diagnostic
assessment. Diagnostic appraisals need to consider the proficiency
level of the employee. Proficiency has been conceptualized as stages
of learning (Anderson, 1982) and as the novice-master continuum.

Anderson (1982) described three stages of learning—declarative,
procedural, and automaticity. According to Anderson’s ACT
model, skill acquisition begins with the learning of simple facts that
must be rehearsed in working memory to be learned. This first
stage of learning is called the declarative stage. During this stage,
skill and knowledge are inert and not well integrated into existing knowledge structures. Performance using these skills and knowledge makes a large demand on attentional and general intellectual resources (Kanfer & Ackerman, 1988). Next, these facts are operated on by procedures; with sufficient repetition, the knowledge becomes proceduralized. This transition from the declarative knowledge stage is called knowledge compilation and it moves the learner to the procedural stage of learning. During the procedural stage, the learner performs more skillfully. Separate pieces of knowledge and procedures now operate as one and the new skills are integrated into existing knowledge structures. The skill is now more context sensitive and operates more quickly. Finally, when the skill is well practiced, it reaches the stage of automaticity—that is, it occurs automatically and in the appropriate context, with little need for attentional resources.

Differences in the mental process models of expert and non-expert performers correspond to different stages of proficiency development. When employees learn a new skill domain, they act and think like novices. They possess novice mental process models. As their proficiency increases, they begin to act and think like experts as they develop expert mental process models.

Expert-novice comparisons entail careful analyses of the strategies, techniques, and thought processes used by experts and novices as they perform tasks. For example, researchers (Chi, Feltovich, & Glaser, 1981; Baker, 1989) have investigated differences between expert chess players and novices, novice and expert physics students, and superior and less skilled readers. Results indicate that experts think in terms of sets of actions or ideas; their ability to remember and reconstruct the information is aided by a more complex and deeper approach used for input processing. They are able to move from big picture thinking to detail thinking and back continually during task performance.

Wagner and Sternberg (1985) examined a different class of knowledge structures and executive control processes across proficiency levels. They studied the “tacit knowledge” that distinguished successful managers and faculty members from less successful managers and faculty members. While they did not explicitly describe successful managers as experts and less successful managers as novices, the approach they used was very similar to that used in expert-novice research. They found that successful managers were better that themselves, managing their careers, and that managers were not characterized with tacit knowledge.

These studies and others have investigated executive control processes, an example, which experts use when they do not successfully and achieve high performance. everyone learns to behave cognitively like experts. What are proficiency concepts within a diagnostic task? To specify for each employee (procedural, or automaticity) for a given skill dimension?

**Exhibit 12.**

**Diagnostic Task for Managerial Proficiency**

1. **Componental**
   A. **Metacomponents**
   1. **Recognizing the expert**
      a. Find ways to recognize them when they become seniors.
   2. **Defining a problem**
      a. Know what the problem is.
      b. Find out whether you can solve it.
      c. Make sure the learner can lead to a solution.
      d. If the problem solving continues.
   3. **Selecting a strategy**
      a. Formulate strategy.
      b. Get approval of people they don’t try to change the plan.
      c. Make sure the plan does not change without notice.
   4. **Allocating resources**
      a. Make sure the time is properly estimated.
      b. Make sure the current plan is not compromised with any others.
well integrated into existing using these skills and knowl-
tional and general intellec-
ction from the declarative compilation and it moves the
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rate as one and the new skills ge structures. The skill is now
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Careful analyses of the strategy processes used by experts and ample, researchers (Chi, Fel-
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processes across proficiency edge" that distinguished suc-
er from less successful man-
ney did not explicitly describe
les successful managers as
very similar to that used in
expert-novice research. They found that expert managers and fac-
ulty members were better than novice managers at managing them-
selves, managing their careers, and managing others. Sternberg and
Wagner provide a list of behaviors and rules of thumb that charac-
terize a manager with tacit knowledge (see Exhibit 12.1).

These studies and others identify specific knowledge structures,
executive control processes, and techniques stored in long-term mem-
ory, which experts use when learning or solving problems. To learn
successfully and achieve higher levels of performance, novices must
learn to behave cognitively like experts. Incorporating these profi-
ciency concepts within a diagnostic appraisal requires the appraiser
to specify for each employee the stage of learning (declarative, pro-
cedural, or automaticity) for a given level of competence (novice-
master) for a given skill dimension. Equipped with this diagnosis, a

Exhibit 12.1. Rules of Thumb
for Managerial Tacit Knowledge.

I. Componential

A. Metacomponents

1. Recognizing the existence of a problem
   a. Find ways to recognize problems as they arise before they become serious.

2. Defining a problem
   a. Know what the problem is before you tackle it.
   b. Find out whether others in authority agree with the way you have defined the problem.
   c. Make sure the level at which you define the problem can lead to a solution.
   d. If the problem seems insoluble, try reformulating it.

3. Selecting a strategy for problem solution
   a. Formulate strategies with built-in flexibility.
   b. Get approval of the strategy from those who matter so they don’t try to sabotage it later.
   c. Make sure the people who should know, do know.

4. Allocating resources
   a. Make sure the time you put in is commensurate with the importance of the problem.
   b. Make sure the company resources you put in are commensurate with the importance of the problem.
Exhibit 12.1. Rules of Thumb for Managerial Tacit Knowledge, cont’d.

5. Solution monitoring
   a. Step back on occasion to take stock of the situation.
   b. Seek hard, concrete data regarding how the solution is going.
   c. Set up multiple independent tests to see how the solution is going.
   d. Monitor results frequently enough to redirect if you need to.

6. Solution evaluating
   a. Have a built-in evaluation procedure for the strategy.
   b. Make sure others will accept the tests as valid.

7. Using feedback
   a. Seek out feedback on your performance from those who matter.
   b. Evaluate the utility of the feedback you receive.
   c. Selectively use the feedback you receive.

B. Performance Components
   1. Balance short-term losses or inefficiencies against long-term gains, and vice versa.
   2. Make sure you hear what someone is saying.
   3. Take a second look at first impressions.
   4. Consider doing the opposite.
   5. Seek to understand things from other points of view.
   6. Follow through on your commitments.
   7. Know when to let people off the hook.
   8. Learn from your mistakes and those of others.
   9. Use humor to defuse difficult situations.
  10. Know when to admit your mistakes.
  11. Know the capabilities, interests, and values of those with whom you are working.
  12. Figure out ways to turn crises into opportunities.
  13. Know when to wait and when not to wait.
  15. Admit when you don’t know something.
  16. Know when to seek help.
  17. Know whom you can and whom you cannot trust.
  18. Know when and how to criticize.
  20. Know when to give up and when not to give up.

II. Experiential Subtheory
   A. Coping with novelty
      1. Ask yourself whether the situation that are now done is
   B. Automatization
      1. Devise effective standards handling routine activities
   C. Shaping
      1. Determine the extent to which you are shaped into what you
Exhibit 12.1. Rules of Thumb for Managerial Tacit Knowledge, cont'd.

21. Know the weaknesses as well as the strengths of your positions.
22. Find ways of getting around your weaknesses, such as delegating.
23. Know what you need to know and what you don’t need to know.
24. Let others save face.
25. Treat others the way you would like to be treated.

C. Knowledge-Acquisition Components
   1. Selective encoding
      a. When barraged with information, ask yourself what the
         important parts are.
   2. Selective combination
      a. Put together disparate sources of information.
   3. Selective comparison
      a. Draw upon past experience, but recognize its limitations
         as well as its domains of generalization.

II. Experiential Subtheory
   A. Coping with novelty
      1. Ask yourself whether there are better ways of doing things
         that are now done in ways you take for granted.
   B. Automatization
      1. Devise effective standard operating procedures for
         handling routine activities.

III. Contextual Subtheory
   A. Adaptation
      1. Know your managerial strengths and make the most of
         them.
      2. Know your managerial weaknesses and find ways to
         compensate for them.
   B. Selection
      1. Try to place yourself in an environment that matches your
         interests, abilities, and values.
   C. Shaping
      1. Determine the extent to which the environment can be
         shaped into what you want it to be.
meaningful development plan can be created that takes employees from their current level of proficiency to the level of an expert.

This conceptualization is actually an oversimplification. There are more stages between declarative knowledge and procedural knowledge and more levels of competence. In fact, there is a continuum between these two points and not discrete stages. One may reasonably assume that the characteristics and interrelationships of knowledge structures and executive control processes change as the learner moves from the declarative stage of a novice to the automaticity stage of a master performer. A complete diagnostic appraisal should be based on a competency model that includes information about the ratee's status on these levels of proficiency and content similar to that contained in Exhibit 12.1.

Developing Diagnostic Performance Appraisal

The steps involved in the development of a performance appraisal are well known and practiced by industrial psychologists. The development of a diagnostic performance appraisal based on a mental process model follows similar steps with some modifications. Table 12.1 contains a list of these steps. The outcome from following these steps is two competency models—one for experts and one for novices. The competency models contain the critical knowledge, skills, heuristics, metacognitive skills, and other characteristics that describe and distinguish expert and novice performers.

There are several unique features to this approach compared to the usual job analysis. First, novices as well as expert job performers are included as subject matter experts. Novices serve as subject matter experts about how novices perform work. They are needed to present their view of KSAO requirements, even if this view is incorrect in many respects. Second, the job analyst's goal is not only to identify critical job requirements but also to characterize the mental process models used by experts and novices. This is a different focus from that of researchers in the usual job analysis work. Third, the content captured by the job analyst is different. In the traditional job analysis, the job analyst captures knowledge, skills, abilities, and other characteristics. In a job analysis whose goal is to develop competency models based on mental process models, the job analyst peels back the onion on the skills and knowledge dimensions and captures other characteristics, heuristics, knowledge structures, the executive control processes used by experts, and given to identifying those characteristics of experts and novices. And finally, a job analysis, competency models based upon social-emotional characteristics of experts and novices. These characteristics are identified by job analysis, but recent research shows the importance in learning, problem solving.

When the job analyst concludes the analysis work is completed, the performance appraisal tool can be developed. This process proceeds much like the work associated with the measurement tool. The methodology involves interview, paper-and-pencil test, and must be developed and the analyst must be trained. There are two important steps in the selection of content. The content allows the appraiser to identify and automatic-automativeness scale that is usually job analyst's goal is that the diagnosis is a traditional appraisal. The job analysis method approach, but must provide the qualitative components of the mental models that are valuable and provide a training program.

The expert and novice expert process models serve as an additional basis for the design of developmental training programs. Novice's content of training programs is to create training programs that focus on the novice-expert stage. The expert-automativeness point of the mental model is designed to select instructional methods, experiences.

Samples of expert and novice are provided in Exhibit 12.1. Each presents examples of methods for the development of a performance appraisal based upon a mental process model.
cared that takes employees to the level of an expert.

versimilation. There is knowledge and procedural tacit knowledge and procedural tacit knowledge. In fact, there is a conflict. Discrete stages. One may stages and interrelationships of control processes change as stage of a novice to the stage of a person. A complete diagnostic model that includes these levels of proficiency is Exhibit 12.1.

nce Appraisal

A performance appraisal is a psychological task. The development of a model based on a mental model with some modifications. The outcome from following one for experts and one for novices. The critical knowledge, other characteristics that are shared among performers. This approach compared to that of expert job performers novices serve as subject matter. They are needed to do, even if this view is incorrect. Analysts' goal is not only to test the knowledge of novices. This is a different job analysis work. Third, different. In the traditional model, knowledge, skills, abilities, and goals is to develop composite models, the job analyst knowledge dimensions and captures other characteristics including metacognitive skills, heuristics, knowledge structures, thinking frames, strategies, and executive control processes used by experts and novices. Special emphasis is given to identifying those characteristics that distinguish experts and novices. And finally, a job analysis for the development of competency models based upon mental process models includes the social-emotional characteristics that characterize experts and novices. These characteristics are often overlooked in traditional job analysis, but recent research has demonstrated their importance in learning, problem solving, and job performance.

When the job analyst completes Step 6 from Table 12.1, the job analysis work is completed and the development of the performance appraisal tool can begin. The work from this stage forward proceeds much like the work entailed in the development of any measurement tool. The method must be selected (for example, interview, paper-and-pencil test, rating scales, and so on). Instructions must be developed and the content must be selected and formatted. There are two important differences, one of which involves the selection of content. The content must be selected in a way that enables the appraiser to identify where on the expert-novice, declarative-automaticity scale the appraisee falls. The other important difference is that the diagnostic assessment will be longer than a traditional appraisal. The job analyst cannot use a "domain sampling" approach, but must provide accurate measurement for all components of the mental models to diagnose the appraisee's deficiencies and provide a training prescription.

The expert and novice competency models based on mental process models serve an additional purpose. The models form the basis for the design of developmental curricula. The KSAOs become the content of training. The goal of the curriculum designer is to create training programs that move the trainee from whatever point on the novice-expert scale he or she currently is toward the expert-automaticity point on the scale. It is the curriculum designer's challenge to select the training content and design instructional methods, experiences, and exercises to achieve that goal.

Samples of expert and novice competency models for a research analyst are provided in Exhibits 12.2 and 12.3, while Table 12.2 presents examples of methods for the development of a performance appraisal based upon a mental process model. There are several
<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identify novice and expert “subject matter experts” who can provide input about critical job requirements, learning, and problem solving for the target job.</td>
<td>The critical job components are associated with learning objectives. The learning objectives are based on the goals the organization has established for the training.</td>
</tr>
<tr>
<td>2</td>
<td>Specify the organization’s learning objectives for the training and then identify the critical job components for the learning objectives of the target job.</td>
<td>This work involves specifying a knowledge domain much like the work done when creating a job knowledge test but reflects how experts organize their knowledge.</td>
</tr>
<tr>
<td>3</td>
<td>Based upon the critical job requirements, develop a hierarchical knowledge taxonomy of job knowledge components by interviewing subject matter experts and reviewing job information such as training material, job aids, and technical documentation.</td>
<td>This work involves specifying a knowledge domain much like the work done when creating a job knowledge test, but reflects how novices organize their knowledge—including mistaken and inaccurate constructions.</td>
</tr>
<tr>
<td>4</td>
<td>Interview novices and develop a hierarchical knowledge taxonomy that reflects a novice’s view of the knowledge domain.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Identify expert and novice metacognitive skills and executive control processes by reviewing the relevant research literature and interviewing experts and novices about strategies, heuristics, techniques, rules of thumb, and schema they use when applying their knowledge to learn and solve problems.</td>
<td>Note in particular skills and processes that differentiate experts and novices.</td>
</tr>
<tr>
<td>6</td>
<td>Identify expert and novice social-cognitive and emotional processes by reviewing the relevant research literature and interviewing experts and novices about strategies, heuristics, techniques, rules of thumb, and schema they use when applying their knowledge to learn and solve problems.</td>
<td>Note in particular skills and processes that differentiate experts and novices.</td>
</tr>
</tbody>
</table>
3 Based upon the critical job requirements, develop a hierarchical knowledge taxonomy of job knowledge components by interviewing subject matter experts and reviewing job information such as training material, job aids, and technical documentation.

4 Interview novices and develop a hierarchical knowledge taxonomy that reflects a novice's view of the knowledge domain.

5 Identify expert and novice metacognitive skills and executive control processes by reviewing the relevant research literature and interviewing experts and novices about strategies, heuristics, techniques, rules of thumb, and schema they use when applying their knowledge to learn and solve problems.

6 Identify expert and novice social-cognitive and emotional processes by reviewing the relevant research literature and interviewing experts and novices about strategies, heuristics, techniques, rules of thumb, and schema they use when setting goals, motivating themselves, dealing with frustration, and so on when learning and solving problems.

7 Summarize the results of Steps 4, 5, and 6 into two mental process models, one for novices and one for experts.

8 Use the competency models to create the performance appraisal tool. Select content from the expert and novice models to develop a tool. Choose appropriate methods to measure the content.

Note in particular skills and processes that differentiate experts and novices.

Note in particular skills and processes that differentiate experts and novices.

This work involves specifying a knowledge domain much like the work done when creating a job knowledge test but reflects how experts organize their knowledge— including mistaken and inaccurate constructions.

Blending the content from the two competency models will provide an appraisal tool that scales the appraisee from novice at the declarative knowledge stage to expert at the automaticity stage.
points to note when examining these models. First, the expert list is considerably longer than the novice list. This is to be expected because an expert knows more than a novice and this difference is reflected in the models. Second, the structure for expert statistics knowledge is more sophisticated and has more levels than the statistics knowledge structure for novices. This is reflective of a common characteristic that distinguishes experts and novices. Experts organize their knowledge differently such that it enables them to process information more quickly, more deeply, and more complexly. Third, the novice model includes errors of omission and commission. Compared to the expert model, many items are not included in the novice model—errors of omission. Also, several items in the novice model are known to be associated with poorer performers—errors of commission. For example, under goal setting, the novice performer sets "do best and general goals." The research (Latham & Locke, 1990) is clear that this leads to performance that is less than optimal. Fourth, novices are not without skills. The novice competency model does not consist only of incorrect knowledge and errors of commission. Novices are not completely incompetent. In fact, depending upon the target population chosen for the job analysis, the researcher might find that the novices are moderately competent. This should not present a problem. As in any effort to develop a measurement tool, the developer must ensure that the tool adequately measures the range of ability for which the tool will be applied. Fifth, note that much of the content of the competency models comes from the research literature. The job analyst developing competency models based on mental process models will find the research literature a valuable source of content for competency models. For example, findings regarding mastery goals, attributional style, and checking and organizing written material are well supported by the research literature and readily adaptable to a competency model. Finally, the job analyst should be sure to include a knowledge structure for the job knowledge information that reflects how experts process and organize their knowledge domain. The research literature is very clear that this is an important feature of experts and distinguishes them from nonexperts. The job analyst should be sure to interview experts and novices and identify the knowledge structures that they use. This distinction has much diagnostic and instructional significance.

Exhibit 12.2. MPM: Research Approach

I. Hierarchical Taxonomy of Performance Appraisal
A. Knowledge Domain for Performance Appraisal
   1. Nonparametric Methods
      a. One-Sample Distribution
         - Binomial Test
         - Kolmogorov-Smirnov
         - Chi-Square
      b. Two-Categorical Distribution
         - Fischer Exact Test
         - Kolmogorov-Smirnov
         - Mann-Whitney
         - Sign Test
         - Chi-Square
      c. Multiple-Categorical Distribution
         - Chi-Square
         - Kruskal-Wallis
         - Friedman test
         - Odds ratios
         - Loglinear models
      d. Correlational Methods
         - Contingency table
         - Spearman rank
         - Kendall coefficient

2. Parametric Methods
   a. Descriptive
      - Measures of central tendency
      - Measures of variability
   b. Inferential
      - One-sample tests
      - Two-sample tests
      - Independent samples
      - Related samples
      - General Linear Model
      - Multiple regression
      - ANOVA
      - ANCOVA
      - Multivariate analyses
      - MANOVA
      - Canonical correlation
      - Discriminant analysis
e models. First, the expert list
ice list. This is to be expected
a novice and this difference is
structure for expert statistics
has more levels than the sta-
es: This is reflective of a com-
s of experts and novices. Experts
such that it enables them to
more deeply, and more com-
cludes errors of omission and
model, many items are not
ors of omission. Also, several
be associated with poorer
example, under goal setting,
ld general goals.” The research
this leads to performance that
are not without skills. The
consist only of incorrect knowl-
des are not completely incom-
target population chosen for
find that the novices are mod-
resent a problem. As in any ef-
developer must ensure that
ability for which the tool
of the content of the compe-
literature. The job analyst de-
mental process models will
source of content for compe-
regarding mastery goals, attri-
ting written material are well
ad readily adaptable to a com-
should be sure to include a
edge information that reflects
knowledge domain. The re-
is an important feature of ex-
onexperts. The job analyst
and novices and identify the
his distinction has much diag-

Exhibit 12.2. MPM-Based Performance Appraisal
Research Analyst—Expert Model.

I. Hierarchical Taxonomy of the Knowledge Domain
A. Knowledge Domain for Critical Incidents: Statistical Methods
1. Nonparametric Methods
   a. One-Sample Data
      • Binomial Test
      • Kolmogorov-Smirnov
      • Chi-Square
   b. Two-Category Data
      • Fischer Exact Test
      • Kolmogorov-Smirnov
      • Mann-Whitney U Test
      • Sign Test
      • Chi-Square
   c. Multiple-Category Data
      • Chi-Square
      • Kruskal-Wallis
      • Friedman two-way analysis of variance
      • Odds ratios
      • Loglinear methods
   d. Correlational Methods
      • Contingency Coefficient
      • Spearman rank correlation
      • Kendall coefficient of concordance
2. Parametric Methods
   a. Descriptive
      • Measures of Central Tendency
      • Measures of Dispersion
   b. Inferential
      • One-sample means test
      • Two-sample means test
         Independent samples
         Related samples
      • General Linear Model
         Multiple regression
         ANOVA
         ANCOVA
      • Multivariate
         MANOVA
         Canonical correlation
         Discriminant analysis
Exhibit 12.2. MPM-Based Performance Appraisal
Research Analyst—Expert Model, cont’d.

- Data reduction techniques
  - Factor analysis
  - Cluster analysis
  - Multidimensional scaling
- Correlational techniques
  - Pearson correlation
  - Partial correlation
  - Part correlation
- Bayesian methods

B. Knowledge Domain for Critical Incidents:

1. Research Design
   - Proof, and the logic of the scientific method

2. Validity
   - Internal validity
   - Threats to internal validity
   - External validity
   - Threats to external validity

3. Quasi-experimental design
   - One-Group Posttest only
   - One-Group Pre- and Posttest
   - Control Group Pre- and Posttest
   - Repeated measure designs

4. True experimental design
   - Randomized control group designs
   - Randomized block designs
   - Factorial designs
   - Fractional factorial designs

5. Time-series designs
   - Simple time series
   - Interrupted time series
   - ARIMA models

C. Knowledge Domain for Critical Incidents: Software

1. Windows operating system
2. Basic file manager functions including copying, saving, deleting, moving
3. Basic knowledge of a spreadsheet including formatting, sorting data, and simple statistical calculations
4. Basic knowledge of database software including creating fields, changing formats of fields, editing fields, adding fields and records, and producing reports

II. Processes

A. Metacognitive and executive skills
   1. Clearly defines the problem
   2. Clearly defines the research questions
   3. Evaluates the psychological approach to answer the research questions
   4. Assesses whether the psychological approach answers the research questions
   5. Considers threats to the research questions
   6. Considers previous research questions and should be expected
   7. Considers the type of statistical methods
   8. Considers the practicality of statistical methods
   9. Considers previous research questions and recommends appropriate statistical methods
   10. Distinguishes between descriptive, inferential, and multivariate

11. Distinguishes among descriptive, inferential, and multivariate
12. Organizes and cleans data
13. Applies correct statistical methods
14. Applies statistical methods to test research hypotheses
15. Correctly interprets research findings
16. Recognizes incorrect conclusions
17. Follows a systematic approach
18. Recognizes the well-documented methodological issues
19. Analyzes the data from an objective perspective

B. Social-cognitive and emotional skills

1. Interpersonal skills
   - Expresses understanding
   - Listens carefully
Exhibit 12.2. MPM-Based Performance Appraisal
Research Analyst—Expert Model, cont’d.

II. Processes

A. Metacognitive and executive control processes
1. Clearly defines the hypotheses being tested.
2. Clearly defines the independent and dependent variables.
3. Evaluates the psychometric quality of the metrics used.
4. Assesses whether or not the measurements and research approach answer the questions posed.
5. Considers threats to the internal and external validity of the study design.
6. Considers previous research findings and what results should be expected.
7. Considers the type of measurement used and suitable statistical methods.
8. Considers the practical field limitations of the study and recommends appropriate research methods.
9. Considers previous research findings for similar studies and recommends appropriate research methods.
10. Distinguishes between parametric and nonparametric methods.
11. Distinguishes among types of statistical methods such as descriptive, inferential, univariate, bivariate, and multivariate.
12. Organizes and cleans data to ensure that calculations are based on correct data.
13. Applies correct statistical methods to the problem.
14. Applies statistical methods whose assumptions are satisfied by the data.
15. Correctly interprets the results.
16. Recognizes incorrect results and improbable findings.
17. Follows a systematic approach to analyzing and reporting data.
18. Recognizes the weaknesses in the analysis and recommends actions to overcome them.
19. Analyzes the data using more than one method to ensure results are not dependent upon the method.

B. Social-cognitive and emotional processes
1. Interpersonal skills
   a. Expresses understanding of others’ concerns.
   b. Listens carefully to speaker without interrupting.
Exhibit 12.2. MPM-Based Performance Appraisal
Research Analyst—Expert Model, cont’d.

c. Demonstrates empathy and concern.
d. Modifies communication approach according the listener.
e. Is sensitive to the moods and feelings of others.
f. Understands the strengths and weaknesses of others.

2. Communication skills

a. Oral communication
   • Considers the listener when deciding what to say.
   • Considers what the listener needs to know.
   • Speaks in clear, well-paced complete sentences.
   • Considers how much information should be provided.
   • Considers the current level of knowledge of the listener.
   • Considers the ability of the listener to grasp the concepts and information to be presented.
   • Asks the listener to repeat what was said to confirm understanding.
   • Summarizes what has been said by the speaker to confirm understanding.
   • Considers whether what was said makes sense.
   • Remembers what was said.

b. Written communication
   • There are no grammar, spelling, and punctuation errors.
   • Vocabulary is appropriate for the context and correctly used.
   • The information is factually correct.
   • There is no illogical or contradictory information in the text.
   • The information presented is well organized.
   • Checks to ensure there is no missing information.
   • Writes in a way that is sensitive to the audience in tone and complexity.

3. Problem Solving

a. Defines the problem.
   • Defines terms.
   • Organizes thoughts and articulates them concisely and coherently.
   • Can identify the essential and irrelevant information surrounding the problem.

b. Obtains facts.
   • Uses evidence.
   • Knows how to think
   • Analyzes the factors.
   • Attempts to find a list of alternative solutions to them.
   • Uses mental imagery, so on.
   • Sees similarities artificially apparent.
   • Can represent the exaggeration.

b. Plans how to solve the problem.
   • Looks for similar problems.
   • Makes drawings.
   • Looks for underlying problems.
   • Makes and checks the problem.

4. Goal-Setting

a. Sets specific goals.

b. Sets challenging goals.

c. Seeks positive feedback.

d. Uses feedback to improve or change strategies.

e. Sets mastery goals.
Exhibit 12.2. MPM-Based Performance Appraisal
Research Analyst—Expert Model, cont’d.

- Can structure informally represented problems in such a way that formal techniques (such as mathematics) can be used to solve them.

b. Obtains facts.
   - Uses evidence skillfully and impartially.
   - Knows how to seek information.

c. Analyzes the facts and information.
   - Attempts to anticipate the probable consequences of alternative actions before choosing among them.
   - Uses mental models, heuristics, thinking frames, and so on.
   - Sees similarities and analogies that are not superficially apparent.
   - Can represent differing viewpoints without distortion, exaggeration, or caricaturization.

d. Plans how to solve the problem.
   - Looks for similarities with familiar problems.
   - Makes drawings to represent the problem.
   - Looks for unusual approaches to complex problems.
   - Makes and considers several hypotheses for solving the problem.

e. Attempts to solve the problem.
   - Suspends judgment in the absence of sufficient evidence to support a decision.
   - Avoids logical fallacies.

f. Evaluates progress.
   - Distinguishes between logically valid and invalid inferences.
   - Understands the difference between reasoning and rationalizing.
   - Recognizes that there is usually more than one correct answer to a problem.

4. Goal-Setting
   a. Sets specific goals.
   b. Sets challenging goals that are attainable.
   c. Seeks positive and negative feedback.
   d. Uses feedback to determine the need to increase effort or change strategy.
   e. Sets mastery goals.
Exhibit 12.2. MPM-Based Performance Appraisal
Research Analyst—Expert Model, cont’d.

5. Attributional Style
   a. Focuses on improvement.
   b. Recognizes and focuses own improvement.
   c. Objectively analyzes the cause for failure.
   d. Blames failure on approach and effort.
   e. Attributes failure to external events and success to own skills.
   f. Uses failure as a signal to increase effort.
   g. Recognizes setbacks are temporary.
   h. Believes that failure represents an opportunity for learning and improvement.
   i. Believes that skills are trainable.

6. Persistence
   a. Works hard.
   b. Reacts to failure by spending additional hours solving the problem.
   c. Recognizes that errors are a part of learning and problem solving.
   d. Continues to work in the face of failure.
   e. Tries different approaches.
   f. Experiments with several different approaches before selecting one.

7. Self-Efficacy
   a. Believes in own ability to learn and perform successfully.
   b. Makes positive self-statements while learning and problem solving.
   c. Believes in own ability to control events.
   d.Accentuates the positive aspects of own performance.

I. Hierarchical Taxonomy of Performance
   A. Knowledge Domain for Research Analyst
      1. Descriptive and Inferential
         a. Binomial Test
            • t-test
            • ANOVA
            • Multiple regression
            • Chi-Square
         b. Correlational Methods
            • Contingency Coefficient
            • Pearson Correlation
            • Spearman's rho

   B. Knowledge Domain for Research Analyst
      1. Validity
         a. Internal validity
            • Threats to internal validity
         b. External validity
            • Threats to external validity

      2. Experimental Design
         a. One-Group Posttest
         b. One-Group Pretest
         c. Control Group Posttest
         d. Repeated measures
         e. Randomized Controlled Experiment
         f. Factorial designs

   C. Knowledge Domain for Research Analyst
      1. Windows operating system
      2. Basic file manager for creating, deleting, moving
      3. Basic knowledge of sorting data
      4. Basic knowledge of fields, changing form fields and records, and

II. Processes
   A. Metacognitive and Executive
      1. Clearly defines the problem.
      2. Clearly defines the inferential steps.
      3. Considers previous research and what should be expected.
Exhibit 12.3. MPM-Based Performance Appraisal
Research Analyst—Novice Model.

I. Hierarchical Taxonomy of the Knowledge Domain
A. Knowledge Domain for Critical Incidents: Statistical Methods
   1. Descriptive and Inferential Methods
      a. Binomial Test
         • t-test
         • ANOVA
         • Multiple regression
         • Chi-Square
      b. Correlational Methods
         • Contingency Coefficient
         • Pearson Correlation
         • Spearman’s rho
B. Knowledge Domain for Critical Incidents: Research Design
   1. Validity
      a. Internal validity
         • Threats to internal validity
      b. External validity
         • Threats to external validity
   2. Experimental design
      a. One-Group Posttest only
      b. One-Group Pre- and Posttest
      c. Control Group Pre- and Posttest
      d. Repeated measure designs
      e. Randomized Control Group designs
      f. Factorial designs
C. Knowledge Domain for Critical Incidents: Software
   1. Windows operating system
   2. Basic file manager functions including copying, saving, deleting, moving
   3. Basic knowledge of a spreadsheet including formatting and sorting data
   4. Basic knowledge of database software including creating fields, changing formats of fields, editing fields, adding fields and records, and producing reports

II. Processes
A. Metacognitive and Executive Control Processes
   1. Clearly defines the hypotheses being tested.
   2. Clearly defines the independent and dependent variables.
   3. Considers previous research findings and what results should be expected.
Exhibit 12.3. MPM-Based Performance Appraisal
Research Analyst—Novice Model, cont’d.

4. Considers the type of measurement used and suitable statistical methods.
5. Distinguishes among types of statistical methods such as descriptive, inferential, univariate, bivariate, and multivariate.
6. Organizes and cleans data to ensure calculations are based on correct data.
7. Applies correct statistical methods to the problem.
8. Correctly interprets the results.
9. Follows a systematic approach to analyzing and reporting data.
10. Recognizes the weaknesses in the analysis and recommends actions to overcome them.

B. Social-Cognitive and Emotional Processes

1. Interpersonal skills
   a. Expresses understanding of others’ concerns.
   b. Is sensitive to the moods and feelings of others.
   c. Does not readily share information.
   d. Views relationships as “friends versus others.”
   e. Understands the strengths and weaknesses of others.

2. Communication skills
   a. Oral communication
      • Considers the listener when deciding what to say.
      • Considers what the listener needs to know.
      • Considers the current level of knowledge of the listener.
      • Considers the ability of the listener to grasp the concepts and information to be presented.
      • Speaks too quickly and does not enunciate.
      • Considers whether what was said makes sense.
      • Remembers what was said.
   b. Written communication
      • There are no grammar, spelling, and punctuation errors.
      • Vocabulary is appropriate for the context and correctly used.
      • The information is factually correct.
      • There is illogical or contradictory information in the text.
      • Checks to ensure there is no missing information.

3. Problem Solving
   a. Obtains facts
      • Uses evidence.
      • Knows how to solve a problem.
   b. Analyzes the facts
      • Attempts to answer the question of alternative solutions to the problem.
      • Sees similarities superficially and/or similarities.
   c. Attempts to solve the problem
      • Suspends judgment and looks at evidence to support aspects of problems.
      • Avoids logical analyses and speculations.
   d. Evaluates progress
      • Distinguishes between logical inferences.
      • Understands the possibility of rationalizing.

4. Goal-Setting
   a. Sets “do best” goals
   b. Goals are general
   c. Seeks positive feedback
   d. Uses feedback to improve or change strategy
   e. Compares own performance
   f. Demonstrates pressure

5. Attributional Style
   a. Focuses on internal factors
   b. Recognizes and assesses others’ attributions
   c. Objectively analyzes causes of failure
   d. Blames failure on others
   e. Attributes failure to self
   f. Is discouraged by failure
   g. Believes that skills and attitudes are amenable to training

6. Persistence
   a. Work effort is in proportion to the problem.
Performance Appraisal Model, cont’d.

Exhibit 12.3. MPM-Based Performance Appraisal Research Analyst—Novice Model, cont’d.

3. Problem Solving
   a. Obtains facts.
      • Uses evidence skillfully and impartially.
      • Knows how to seek information.
   b. Analyzes the facts and information.
      • Attempts to anticipate the probable consequences of alternative actions before choosing among them.
      • Sees similarities and analogies that are not superficially apparent.
   c. Attempts to solve the problem.
      • Suspends judgment in the absence of sufficient evidence to support a decision.
      • Avoids logical fallacies.
   d. Evaluates progress.
      • Distinguishes between logically valid and invalid inferences.
      • Understands the difference between reasoning and rationalizing.

4. Goal-Setting
   a. Sets “do best” goals.
   b. Goals are general.
   c. Seeks positive feedback
   d. Uses feedback to determine the need to increase effort or change strategy.
   e. Compares own progress against the progress of others.
   f. Demonstrates positive affectivity.

5. Attributional Style
   a. Focuses on improvement.
   b. Recognizes and focuses own improvement.
   c. Objectively analyzes the cause for failure.
   d. Blames failure on own level of ability.
   e. Attributes failure to self and success to luck.
   f. Is discouraged by failure.
   g. Believes that skills are based on ability and not amenable to training.

6. Persistence
   a. Work effort is inconsistent.
   b. Reacts to failure by spending fewer hours solving the problem.
Cognitive and Emotional Components of the Mental Process Model

Until the 1980s, research on mental process models had an almost exclusively cognitive flavor (Newell, 1990). The learner’s emotional reactions were not considered in the models that cognitive researchers developed; emotional reactions were studied by a separate group of psychologists. Research on the role of emotions and cognition in anxiety, depression, learning orientation, attributional style, motivation, and self-efficacy—and their joint effects on performance—has expanded greatly in recent years. These findings have contributed to the development of a more complete mental process model of performance, one that includes emotional reactions, self-esteem, motivation, and anxiety. This fuller model offers the possibility of developing a more valid assessment and more effective training and development programs.

As an example, let us briefly review some valuable work that identified the causes and effects of cognitive interference on learning. Researchers (for example, Sarason, Pierce, & Sarason, 1996) estimate that the average person experiences about four thousand thoughts per day. This represents the stream of consciousness that includes purposeful, on-task thinking. Effective task performance requires the control of this stream of thoughts. This control is exercised by the executive control processes. Studies of state and trait anxiety demonstrate the extent to which executive control processes are interrupted by anxiety. There are two aspects to the interfering

<table>
<thead>
<tr>
<th>Use a rating of</th>
<th>If the statement is true, rate the level of knowledge.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Possesses little knowledge for this domain and effective in this area.</td>
</tr>
<tr>
<td>2</td>
<td>Possesses knowledge for this domain and effective in this area.</td>
</tr>
<tr>
<td>3</td>
<td>Has demonstrated relationships among concepts and effective in this area.</td>
</tr>
<tr>
<td>4</td>
<td>Has demonstrated an understanding of the relationship of concepts and knowledge.</td>
</tr>
<tr>
<td>5</td>
<td>Has demonstrated the relationships of concepts and knowledge.</td>
</tr>
</tbody>
</table>
Table 12.2. Examples of Developmental Performance Appraisal Methods.

There are different approaches to the creation of a developmentally oriented performance appraisal based upon a mental process model. One approach is to present the rater with the target knowledge, skill, or ability, or other characteristic and the rater then rates the appraisal items on a scale that represents the novice-declarative-expert-automaticity continuum. This approach is created by using the following rating scale and, in this example, selecting non-parametric statistics knowledge content from the expert mental model.

<table>
<thead>
<tr>
<th>Use a rating of</th>
<th>If the statement describes the appraisee</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Possesses little or no knowledge of basic concepts and knowledge for this domain. Cannot perform effectively in this domain.</td>
</tr>
<tr>
<td>2</td>
<td>Possesses knowledge of basic concepts and knowledge for this domain, but has not integrated the concepts and knowledge. Performs and solves problems as a novice.</td>
</tr>
<tr>
<td>3</td>
<td>Has demonstrated understanding of the relationships among the different concepts and knowledge. Can perform and solve problems somewhat effectively in this domain with moderate amounts of help from experts.</td>
</tr>
<tr>
<td>4</td>
<td>Has demonstrated a nearly thorough understanding of the relationships among the different concepts and knowledge. Can perform and solve problems effectively in this domain with little help from experts.</td>
</tr>
<tr>
<td>5</td>
<td>Has demonstrated a thorough understanding of the relationships among the different concepts and knowledge. Can perform and solve problems in this domain as an expert.</td>
</tr>
</tbody>
</table>
Table 12.2. Examples of Developmental Performance Appraisal Methods, cont’d.

<table>
<thead>
<tr>
<th>Nonparametric Methods</th>
<th>1</th>
<th>2</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>One-Sample Data</td>
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<tr>
<td>Binomial Test</td>
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<tr>
<td>Kolmolgorov-Smirnov</td>
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<tr>
<td>Chi-Square</td>
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<tr>
<td>Two-Category Data</td>
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<tr>
<td>Fischer Exact Test</td>
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</tr>
<tr>
<td>Kolmolgorov-Smirnov</td>
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<tr>
<td>Mann-Whitney U Test</td>
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<tr>
<td>Sign Test</td>
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<tr>
<td>Chi-Square</td>
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<tr>
<td>Multiple-Category Data</td>
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<td></td>
</tr>
<tr>
<td>Chi-Square</td>
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</tr>
<tr>
<td>Kruskal-Wallis</td>
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<tr>
<td>Friedman two-way analysis of variance</td>
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<tr>
<td>Odds ratios</td>
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<tr>
<td>Loglinear methods</td>
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<tr>
<td>Correlational Methods</td>
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<tr>
<td>Contingency Coefficient</td>
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<tr>
<td>Spearman rank correlation</td>
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<tr>
<td>Kendall coefficient of concordance</td>
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</tbody>
</table>

Another approach is to obtain statements that are characteristic of novices and experts and the rater rates the statements with respect to the extent that they characterize the appraisee. An example rating scale and appraisal form are provided. The content of the appraisal was obtained from the novice and expert mental models.

<table>
<thead>
<tr>
<th>Use a rating of</th>
<th>If the statement describes the appraisee</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not characteristic.</td>
</tr>
<tr>
<td>2</td>
<td>Characteristic to some extent.</td>
</tr>
<tr>
<td>3</td>
<td>Moderately characteristic.</td>
</tr>
<tr>
<td>4</td>
<td>Characteristic to a large extent.</td>
</tr>
<tr>
<td>5</td>
<td>Extremely characteristic.</td>
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</tbody>
</table>

Table 17.1

<table>
<thead>
<tr>
<th>Appraee Characteristic</th>
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</thead>
<tbody>
<tr>
<td>Clearly defines the hypothesis being tested.</td>
</tr>
<tr>
<td>Clearly defines the independent and dependent variables.</td>
</tr>
<tr>
<td>Evaluates the psychometric quality of the measures and metrics used.</td>
</tr>
<tr>
<td>Fails to assess whether or not the instruments and research approach are appropriate to the questions posed.</td>
</tr>
<tr>
<td>Considers threats to the internal and external validity of the study design.</td>
</tr>
<tr>
<td>Does not consider previous research findings and what results should be expected.</td>
</tr>
<tr>
<td>Considers the type of measurement and suitable statistical methods.</td>
</tr>
<tr>
<td>Does not consider the practical limitations of the study and recommend appropriate research methods.</td>
</tr>
<tr>
<td>Considers previous research findings and recommends similar studies and recommends appropriate research methods.</td>
</tr>
<tr>
<td>Does not distinguish between parametric and non-parametric methods.</td>
</tr>
<tr>
<td>Organizes and cleans data to ensure that calculations are based upon correct data.</td>
</tr>
<tr>
<td>Inconsistently applies correct statistical methods to the problem.</td>
</tr>
<tr>
<td>Applies statistical methods whose assumptions are satisfied by the data.</td>
</tr>
<tr>
<td>Correctly interprets the results.</td>
</tr>
<tr>
<td>Fails to recognize the weaknesses of the particular analysis.</td>
</tr>
<tr>
<td>Analyzes the data using more than one method to ensure results are not dependent upon the method.</td>
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</tbody>
</table>
Table 12.2. Examples of Developmental Performance Appraisal Methods, cont’d.

<table>
<thead>
<tr>
<th>Appraisee Characteristic</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<th>5</th>
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<tbody>
<tr>
<td>Clearly defines the hypothesis being tested.</td>
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<tr>
<td>Clearly defines the independent and dependent variables.</td>
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<tr>
<td>Evaluates the psychometric quality of the metrics used.</td>
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</tr>
<tr>
<td>Fails to assess whether or not the measurements and research approach answers the questions posed.</td>
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</tr>
<tr>
<td>Considers threats to the internal and external validity of the study design.</td>
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<tr>
<td>Does not consider previous research findings and what results should be expected.</td>
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</tr>
<tr>
<td>Considers the type of measurement used and suitable statistical methods.</td>
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</tr>
<tr>
<td>Does not consider the practical field limitations of the study and recommends inappropriate research methods.</td>
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</tr>
<tr>
<td>Considers previous research findings for similar studies and recommends appropriate research methods.</td>
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</tr>
<tr>
<td>Does not distinguish between parametric and non-parametric methods.</td>
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</tr>
<tr>
<td>Organizes and cleans data to ensure calculations are based upon correct data.</td>
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</tr>
<tr>
<td>Inconsistently applies correct statistical methods to the problem.</td>
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<tr>
<td>Applies statistical methods whose assumptions are satisfied by the data.</td>
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<tr>
<td>Correctly interprets the results.</td>
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<tr>
<td>Fails to recognize the weaknesses in the analysis.</td>
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<tr>
<td>Analyzes the data using more than one method to ensure results are not dependent upon the method.</td>
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</tbody>
</table>
anxiety. One is the occurrence of non-task-related cognitions and the other is physiological arousal. When a learner feels unduly anxious, attentional resources are drawn to non-task-related stimuli associated with the anxiety. The source of the stimuli may be external or internal.

The nature of the cognitive interference can be explained, in part, by worry and rumination. People who are depressed report a larger portion of their stream of consciousness is spent thinking depressive thoughts compared to nondepressed subjects, and anxious subjects report that they have less control over the content of their stream of consciousness (Kroll-Mensing, 1992). Worry and rumination are not easily controlled. Evidence suggests that negative thoughts gain attention even at an unconscious level.

This line of research shows that emotion-related constructs can have significant effects on executive control processes and ultimately on task performance. In addition, these constructs are significantly influenced by cognitions that define and maintain anxiety, depression, worry, and stress. At best, current appraisals may attempt to evaluate the extent to which the employee concentrates on task performance during the work day. Equipped with appraisal content about the part emotions play in mental process models, future appraisals can focus on both the emotional and cognitive factors that underlie the employee's attention and performance. Such an appraisal can be the basis of developmental strategies specifically directed at, for example, learning to avoid external cues that trigger worrisome thoughts.

Other lines of research that have yielded useful content for appraisals based on mental process models include work done by Dweck on mastery orientation and work by Bandura on self-efficacy. Dweck's studies (1986) of school-age children identified two work orientations that affect academic performance. For those with a mastery orientation, the learner's attentional focus is on developing competence. Failure represents a skill deficit needing improvement, and feedback about skill deficiencies is viewed as an opportunity for improvement. In contrast, those with a performance orientation constantly compare their performance to that of others, see failure as reflective of a lack of ability, and consequently view performance feedback as threatening. The negative effects of having a performance orientation are greater for those with low self-efficacy than for those with high self-efficacy.

Self-efficacy has been found to influence motivation, attributions, anxiety, and the risk of depression. Low self-efficacy results in more negative self-efficacy while working on a task, which disrupts control processes and reduces performance (Sarason et al., 1996). Self-efficacy will influence one's readiness to appraise and act. Those with higher self-efficacy believe they can handle and then persevere long-term (Locke, 1990). In addition, self-efficacy can influence performance through its impact on attributions. Employees with high self-efficacy are more likely to attribute success to ability and those higher in self-efficacy are more likely to attribute failure to effort. Failure, then, has a more negative impact on low self-efficacy. In learning situations, the role of self-efficacy becomes even more important, and, other factors, affect how people respond to various situations. We have argued, developmentally, the employee's view of performance is the key to understanding the role of self-efficacy.

We have seen, then, that self-efficacy, performance, arousal, expectations, and other factors, affect how people respond to various situations. We have argued, developmentally, the employee's view of performance is the key to understanding the role of self-efficacy. First, in the face of failure, some experience cognitive interference, with learned helplessness, provided instructions, and more, leading to a performance orientation toward performing. This can inhibit learning. A more competent approach is to focus on the emotional factors and the cognitive factors, leading to more effective development plans.

The literature reviewed provides evidence of the importance of the competency model based on the work of Bandura. In Exhibit 12.2 and 12.3, we were introduced to the concept of self-efficacy. For example, in Exhibit 12.3, under the competency identified that poor performance, it was noted that low self-efficacy and this finding is used as an indicator of potential problems. It can be identified with respect to how serious the situation is.
n-task-related cognitions and en a learner feels undue an to non-task-related stimuli as- the stimuli may be external reference can be explained, in x who are depressed report a sciousness is spent thinking depressed subjects, and anx- is control over the content of (Mensing, 1992). Worry and Evidence suggests that nega- in unconscious level. tion-related constructs can notrol processes and ultimately se constructs are significantly and maintain anxiety, depres- int appraisals may attempt to jee concentrates on task per- pped with appraisal content al process models, future ap- nal and cognitive factors that d performance. Such an ap- al strategies specifically di- bid external cues that trigger yielded useful content for models include work done by work by Bandura on self- hool-age children identified mic performance. For those r’s attentional focus is on de- hts a skill deficit needing in- deficiencies is viewed as an ent, those with a perfor- ere their performance to that a lack of ability, and conse- is threatening. The negative nation are greater for those ith high self-efficacy.

Self-efficacy has been found to have a strong impact on goal setting, motivation, attributions of success and failure, perseverance, anxiety, and the risk of depression (for example, see Bandura, 1991). Low self-efficacy results in more negative thoughts and negative affect while working on a task, which in turn interferes with executive control processes and reduces attention to task-relevant feedback (Sarason et al., 1996). Self-efficacy also influences the goals and personal standards one sets for oneself prior to task performance. Persons with higher self-efficacy set more challenging goals to begin with and then persever longer in the face of failure (Latham & Locke, 1990). In addition, self-efficacy influences affective reactions to failure through its impact on attributions. People lower in self-efficacy are more likely to attribute failure to their own lack of ability and those higher in self-efficacy tend to attribute it to a lack of effort. Failure, then, has a more emotionally crippling effect on those low in self-efficacy. In learning situations that routinely involve failure, the role of self-efficacy becomes particularly important.

We have seen, then, that mastery versus performance orientation, arousal, expectations, self-appraisals, and self-efficacy, among other factors, affect how people learn and perform. Further, as we have argued, development naturally involves failure and frustration as the employee progresses from incompetence to competence. The research we have reviewed here sensitizes us to two important processes that influence learning and performance. First, in the face of failure, some individuals experience significant cognitive interference, with less efficient strategic plans, fewer self- provided instructions, and more time on off-task thoughts. Second, orientation toward performance can significantly facilitate or inhibit learning. A more complete appreciation of both the cognitive and the emotional factors can help us design and implement more effective developmental programs.

The literature reviewed provides some intriguing examples of how research findings can be used by a job analyst to develop a competency model based on a mental process model. Referring back to Exhibits 12.2 and 12.3, note how these research findings were translated into content for the competency model. For example, in Exhibit 12.3, under the category of self-efficacy, the literature identified that poor performers make negative self-statements and this finding is used as an item in the competency model and can be rated with respect to how well it characterizes the appraisee.
Cognitive Components of Mental Process Models and Employee Development

Thus far we have discussed how research findings and a mental process model approach to competency models and performance appraisals provide a new approach to the appraisal-development challenge. Next we will focus on the development part of the challenge. We have defined development as a process of learning. Research on the mental process model has contributed to the development of a theory of instruction that can guide employee development. This research answers the question, What should be taught? Putting the answer succinctly, development must be designed to teach novices the executive control processes and knowledge structures used by experts. The following describes the use of research findings on mental process models to design training curricula.

According to Glaser and Bassock (1989), effective curricula provide instruction in three areas: functional, proceduralized skill and knowledge (progressing from declarative to procedural knowledge); self-regulatory skills (or executive control processes); and knowledge structures and the organization of knowledge for problem solving. Glaser and Bassock argue that every developmental plan should be evaluated with respect to the extent that it addresses all three components.

A few researchers have used the influence of these three components on the effectiveness of training design. In one line of research, Nisbett (1993) looked at a number of studies in which abstract, general knowledge structures were used to teach students to apply the "law of large numbers" in statistical problem solving. The law of large numbers states that for a given attribute, a larger sample is required to obtain an accurate estimate of the overall average when the attribute is variable than when the attribute has little variability. Nisbett found that when abstract rules were made more concrete by casting them in pragmatic terms involving familiar concepts, instruction was more effective. For example, permissions and obligations are abstract logical rules that can be taught by using concrete, familiar concepts. The rules are similar and related. Permission enables action only when it has been obtained, and obligation requires action when a specific situation (such as permission) occurs. Nisbett reported an obligation study in which subjects were asked to indicate whether they had listed an item on the reverse side. Many subjects were unable to do this. But subjects were much more accurate when they were asked to indicate whether they had listed the item on the reverse side. This increased obligation more concrete instruction and rationale prompted the subjects to remember the knowledge structure of obligations and facilitated their ability to comply.

Brown (1989) investigated comprehension and developed a reciprocal teaching model of reading, and studies of the differences between experts and novices. Reciprocal teaching design involves asking knowledge structures for relative knowledge. Davidson (1989) developed a model of metacognitive thinking skills. The approach involves using a group analysis of problem-solving strategies, processes and strategies, and general problem-solving strategies.

A final example of the use of a mental process model to guide instruction is that of artificial intelligence. Various systems have been developed that are built on the knowledge structures and executive control processes and strategies used to solve problems, and these differences. An example of this is the system developed by Anderson (1983) for tutoring as computer-based systems for intelligence, applying an approach that involves developing a cognitive model (or mental model) of the target skill from which the system can learn and solve the problems. The system is designed to learn and problem solving strategies, knowledge structures and rules guided by
Internal Process Development

Research findings and a mental tendency model and performance of the appraisal-development part of the challenge. process of learning. Research on the development of a employee development. This re-should be taught? Putting the an- phrase designed to teach novices the knowledge structures used by ex-sue of research findings on men-t curricula.

Lock (1989), effective curricula functional, proceduralized skill declarative to procedural knowledge control processes); and mization of knowledge for progres that every developmental aspect to the extent that it ad-e influence of these three combining design. In one line of re-s a number of studies in which thes were used to teach students are in statistical problem solving. at for a given attribute, a larger atimate estimate of the overall av- than when the attribute has lit-when abstract rules were made | pragmatic terms involving f-p more effective. For example, per-tract logical rules that can be concepts. The rules are similar- tion only when it has been ob-tion when a specific situation ttt reported an obligation study

in which subjects were asked to check for certain words on the reverse side of a form if it contained the word *entering* on the front side. Many subjects were unable to perform this task successfully. But subjects were much more successful when given a concrete context and rationale: they were airline passengers deplaning in a new country. If they had the “entering” form, they were required to indicate whether they had been exposed to any of the diseases listed on the reverse side. In Nisbett’s view, making the abstract obligation more concrete and familiar by providing context and rationale prompted the subjects to draw on their existing knowledge structure of obligations, and these knowledge structures then facilitated their ability to comprehend and perform the task.

Brown (1989) investigated methods to teach reading comprehension, and developed a method—*reciprocal teaching*—based on studies of the differences between expert readers and those less expert. Reciprocal teaching develops executive control processes and knowledge structures for reading comprehension. Sternberg and Davidson (1989) developed a similar instructional approach to teach thinking skills. The approach comprises four stages: familiarization, group analysis of problem-solving procedures, labeling of mental processes and strategies, and application of labeled processes to initial problems.

A final example of the use of the components of a mental process model to guide instructional design comes from the field of artificial intelligence. Various forms of expert systems have been developed that are built on what we have been calling knowledge structures and executive control processes. Knowledge engineering is an approach that expert-systems researchers use to define the knowledge structures and executive control processes that experts used to solve problems, based on an analysis of expert-novice differences. An example of this approach is an intelligent tutoring system developed by Anderson (1993). He defines intelligent tutoring as computer-based systems for instruction using artificial intelligence, applying an approach he calls “model-tracing.” This involves developing a cognitive model (that is, a mental process model) of the target skill from a set of rules or strategies that can solve the problems. The system is built on the assumption that learning and problem solving require the acquisition of knowledge structures and rules guided by executive control process.
Common to the approaches used in this research is the explicit use of mental process models as a basis of the design and the content of instruction. This work demonstrates that the value of mental process models is not limited to better diagnosis. Effective instruction starts with the learner’s current knowledge structures and executive control processes and facilitates the learner’s development toward expert performance by providing instruction in the mental process models used by experts.

**Emotional Components of Mental Process Models and Employee Development**

Findings concerning the emotional components of mental process models can also help guide instructional design. Similar to the research on cognitive components discussed earlier, this research provides answers to the question, What should be taught? Traditionally, it is within the domain of psychotherapy to teach someone to overcome emotions and cognitions that interfere with the performance of basic tasks of day-to-day life. An otherwise well-adjusted employee whose cognitions and emotions inhibit development is not necessarily mentally ill, but he or she does require remediation for these problems in order to become more effective at work.

While numerous studies indicate that people who worry excessively perform poorly in terms of learning and performance, little research exists regarding the direct impact of interventions aimed at “emotional remediation.” The evidence that does exist, however, provides some guidance for the design of interventions aimed at remediating the emotional components of the mental process model.

In one study, Wege and Moller (1995) examined the effectiveness of training to improve the social problem-solving skills of students. Poor social problem solvers were characterized by low self-efficacy for this skill, poor executive control processes in the form of inattention to task-related cues and a focus on interfering emotional responses, and an orientation to believe that failure was due to a lack of innate ability. The remedial program, eight weekly fifty-minute training sessions directly aimed at the emotional components, proved successful. The gains attained by the students were sustained in follow-up measures 6 months after training.

Fiedler (1995) found that leaders with high leadership performance of highly experienced but lower intelligence employees improved after three two-hour sessions combining breathing exercises and restructuring. This intervention improved the performance of both groups, as measured on a posttest three months later.

In an entirely different profession, a variety of interventions directed at regulating emotions and self-devaluative cognitions are applied (Barnett, 1995); teaching a relaxation response as a means to regain attentional control, increasing attentional control, increase attention, decrease negative cognitions; and a “self-regulation” enables the athlete to focus on as a tennis serve to precisely regulate emotions have a direct effect on regulation to control task-related arousal (Nideffer, 1993); cognitive restructuring; and self-instructional task-relevant stimuli. These interventions have, in addition to the additional benefit of increasing externally-induced arousal (Smith, 1995).

These various lines of research focus on the emotional components of mental process models and have direct effects on successful interventions that might influence the model constructs. These emotional components, a well-articulated...
sustained in follow-up measures collected one week and two months after training.

Fiedler (1995) found that, under stressful conditions, the leadership performance of highly intelligent but inexperienced leaders deteriorated more than the performance of those with more experience but lower intelligence. Both groups of leaders received three two-hour sessions consisting of muscle relaxation training, practice with breathing exercises to reduce stress, and cognitive restructuring. This intervention improved the leadership performance of both groups, as measured with an in-basket exercise. Leaders with high intelligence performed more poorly than those with low intelligence before and during training, but performed better on a posttest three months later.

In an entirely different performance domain, Smith examined a variety of interventions designed to enhance athletic performance. Successful interventions included increases in social support from coaches and teammates in order to reduce distracting self-devaluative cognitions and negative emotions (Smith, Smoll, & Barnett, 1995); teaching a refocusing technique called "centering" as a means to regain attentional control and reduce physiological arousal (Nideffer, 1993); mental rehearsal with imagery to gain attentional control, increase attention to task-relevant cues, and avoid negative cognitions; and a "soft focus–hard focus" technique that enables the athlete to focus or "zoom in" on a critical stimulus such as a tennis serve at precisely the right moment. Several stress management interventions have proven to be effective, including self-regulation to control task-irrelevant responses (Smith, 1980); relaxation training to reduce physiological arousal (Smith & As cough, 1985); cognitive restructuring to counter self-defeating ruminations; and self-instructional training to refocus attention to task-relevant stimuli. These latter techniques were found to have the additional benefit of increasing self-efficacy and reducing anxiety-induced arousal (Smith & Nye, 1989).

These various lines of research suggest two conclusions. Emotional components are important constructs in a mental process model and have direct effects on the learning process, and successful interventions that make explicit use of mental process model constructs can be designed. As in the case of the cognitive components, a well-articulated understanding of the emotional
components of mental process models can guide instructional design and development.

**Emotional Components and Feedback**

In our discussion, we have seen how cognitive and emotional components mediate the linkage between diagnosis and development. Consider the typical supervisory feedback session. Explanatory style and locus of control may affect an employee's self-diagnosis, which in turn influences the way the employee reacts to the diagnosis presented by a supervisor or an assessor and the approach the employee takes to implementing a developmental plan. Similarly, these reactions may be influenced on the emotional side by trait anxiety or positive affectivity.

Given the critical role played by self-efficacy in learning, we would expect that self-esteem would mediate the appraisal-development linkage. Those high in self-esteem should invest more effort in development, given their stronger expectation for the development to result in enhanced proficiency. Renn and Prien (1995) recently varied the frequency with which experimental subjects received feedback on task performance. They found that subjects high in self-esteem reacted more positively to frequent feedback than subjects low in self-esteem did. Notwithstanding these preferences, Brockner's (1988) programmatic research on behavioral plasticity has demonstrated that feedback is more likely to affect the subsequent behavior of those low in self-esteem. Those low in self-esteem are more likely to be socially insecure and as a consequence more sensitive to cues relevant to social approval. Thus they are more likely to attend to performance information provided by supervisors and use that information to guide future behavior to avoid the risk of future disapproval. In contrast, those high in self-esteem would be less likely to respond to supervisor feedback information. Moreover, Korman (1976) has demonstrated that those low in self-esteem are more likely to expect negative feedback and consequently more likely to attribute the causes of performance problems to their own lack of skill relative to those high in self-esteem. We would expect, then, that attributing poor performance to lack of skill is more likely to stimulate efforts at skill improvement than attributing poor performance externally—to bad luck, for instance.

We need to be aware, however, of the potential of feedback to lower the sense of self-efficacy and thereby influence learning.

As in other applications of self-regulation processes, components to complex, real-world tasks may be better understood. For example, in the case of self-esteem, these results may be mediated by a number of important variables, including the role of personality variables, the context of the feedback, and the nature of the underlying mechanisms.

**Appraisal and Development**

Before leaving this topic, it is useful to consider the potential of appraisal feedback to support subsequent development. This question has not been addressed in the literature. Tharenou performed a field study on an appraisal agency that was introduced into aBritish study (Tharenou, 1995). She compared data from employees who had participated in the appraisal process and from a parallel group of employees who had not. Her results showed that the appraisal feedback was more likely to enhance the perceived self-efficacy of employees. For example, this might be the result of a change in the appraisal process. Nonetheless, these results suggest that the intervention may be particularly effective in enhancing self-efficacy if they are positively reinforced.

Kluger and DeNisi (1996) conducted a meta-analysis of the effects of feedback on job performance. The review was based on a sample of over 23,000 subjects and concluded that the effects of feedback are significant.
We need to be aware, however, that potentially offsetting the receptivity of those low in self-esteem to negative feedback is a lower sense of self-efficacy concerning the extent to which acting on the developmental feedback will actually result in successful learning.

As in other applications of theories of cognitive-emotional components to complex, real-world work settings, the linkages between key components and the criteria we expect those constructs to influence need to be carefully thought out (Adler, 1996). As in the case of self-esteem, these relationships tend to be complex and mediated by a number of important factors, and as a consequence the role of personality variables may be obscured without consideration of the underlying mental process model.

**Appraisal and Development**

Before leaving this topic, it might be worth flipping around the essential thrust of this chapter: Does the conduct of performance appraisal make subsequent development more effective? Interestingly, this question has not been much addressed. There is a recent Australian study (Tharenou, 1995) that sheds some light on this issue.

Tharenou performed a field experiment in an Australian federal agency that was introducing a formal performance appraisal process. She was able to collect both attitudinal and performance data from employees who were subjected to the new appraisal process and from a parallel group of employees not yet part of the appraisal process. Her results indicated that the presence of an appraisal process, while enhancing employee satisfaction, did little to enhance the perceived effectiveness of employee training. Of course, this might be the result of the lack of resources assembled to support postappraisal development in that particular organization. Nonetheless, these results should serve as a caution to any expectation that training programs are somehow automatically enhanced if they are positioned as a follow-up to appraisal.

Kluger and DeNisi (1996) recently conducted an exhaustive meta-analysis of the effects of performance feedback on subsequent job performance. The review analyzed 607 effect sizes and a pooled sample of over 23,000 subjects. Scholars in our field have generally assumed that the effects of feedback are uniformly positive. Indeed,
the provision of feedback—compared to a no-feedback control—generally does enhance later performance (the average effect size was +.41). However, in a third of the studies, the provision of feedback actually had a negative impact on subsequent performance. Control theory would predict, for example, that someone who has invested very little effort but is told his customer service skills are adequate, if not exceptional, might in fact decrease the effort invested in serving customers. In addition, Kluger and DeNisi (1996) suggest that feedback may focus attention on the self, rather than on the task, inducing a performance rather than a mastery orientation—which in turn leads to performance decrements.

More germane to our interest, feedback may indicate the need to improve performance but not provide a sufficiently clear and detailed path to improvement. If reviewers fail to specify in detail particular developmental needs and action to be taken in pursuit of them, employees may be left more frustrated and confused than they were prior to feedback.

**Evaluating Emerging Practice**

As we noted at the outset, there is a growing appreciation of the value of appraisal as a basis for developmental planning. This appreciation is manifest in several areas of the appraisal process.

- **Timing.** Driven in part by the increasingly dynamic workplace, annual reviews are being complemented by more frequent appraisals. Quarterly and even monthly performance reviews, long common in sales positions, are now true of other functions. Increasingly these reviews also examine developmental needs. More frequent appraisal allows for supervisors and subordinates alike to track learning, changed behavior, and development. It also allows for “small wins” to help sustain behavior change.

  For example, one major credit card company uses an external group of professional assessors to remotely and unobtrusively monitor a random sample of calls and evaluate the customer service skills of their telephone representatives. Supervisors are provided with behaviorally detailed reports on a monthly basis, identifying each representative’s relative strengths and weaknesses. These reports are initially used as the basis for developmental planning and coaching. Over the course of a year, improvements taking place are noted, and interventions are added. Developments in customer service may indeed best be placed into the hands of that employee. However, in one study of the appraisee and the skill of those activities requires multiple opportunities. In today’s downsized organization, sufficient opportunity to observe and accurately diagnose specific developmental needs may be rare. In soliciting self-appraisals may have relative value in soliciting self-appraisal. Employees are more in accord with their own self-appraisals.

- **Value of Third-Party Assessors.** In the increased use of multisource feedback, customer input, there appears to be third-party assessors to provide feedback to employees. Shadow managers may also be reflected in the role of employee managers through feedback and personal training opportunities.

  What we may be seeing here is (explicit) recognition that the task of development may be too complex and is best given to “peripheral” appraisers.
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card company uses an external motely and unobtrusively monitoring the customer service adevaluators. Supervisors are provided on a monthly basis, identifying strengths and weaknesses. These reversion developmental planning and

coaching. Over the course of time, these monthly evaluations, generated by a remote staff of objective assessors who are blind to the interventions taking place at the workplace, are used to track improvements in customer service skills.

Source. Supervisors remain the most common source of appraisals. Nonetheless, the use of multisource appraisals has grown dramatically over the past decade (London & Smither, 1995). This trend, too, may signal at least an implicit recognition of the developmental value of appraisals. Judgment about the economic value of an employee’s outputs to the business objectives of his or her unit may indeed best be placed in the hands of the manager responsible for that employee. However, an accurate description of the activities of the appraisee and the skills brought to bear on the conduct of those activities requires multiple perspectives. This is especially true in today’s downsized organizations, where managers may have insufficient opportunity to observe each employee enough to accurately diagnose specific developmental needs. Moreover, while self-appraisals may have relatively little value in the context of outcome evaluation for the purposes of, say, reward allocation, there is real value in soliciting self-appraisal to identify areas for development. Employees are more likely to act on feedback that is consistent with their own self-appraisals (Korsgaard, 1996).

Value of Third-Party Assessment and Observation. In line with the increased use of multisource feedback, including in some cases customer input, there appears to be an increasing use of external third-party assessors to provide developmental appraisal. We have already described the use by a major credit card company of third-party assessors to monitor and assess the customer contact skills of telephone service representatives. Other firms are using third-party monitoring for stock brokers, software help lines, travel agents, and telecommunications company service representatives. This trend may also be reflected in the advent of “executive coaches” who shadow managers through their day and provide objective feedback and personal training on an ongoing basis.

What we may be seeing here is an implicit (and occasionally explicit) recognition that the task of providing effective diagnosis and remediation may be too complex and burdensome for most managers and is best given over to “performance enhancement professionals.”
Content. Appraisals are making increasing use of competencies. The focus of appraisal has been pushed back from outputs to the activities that produce those outputs to the competencies that drive those activities. The titles of the target competencies used in a particular organization have become artifacts of that organization's culture; the organization's particular competency model helps structure how people in that organization see themselves and others.

We are suggesting that the focus of appraisal be pushed back yet another step to the roots of an individual's current skill level in a given competency. The research and theory around the notion of the mental process model indicates strongly that to diagnose and develop a person more effectively, it is insufficient merely to ascertain, say, that interpersonal skills are weak and need improvement, even if this appraisal is absolutely accurate. A finer level of analysis is required.

There are many skills that are contained in appraisals. For example, cognitive ability, problem solving, decision making, planning and organizing, reasoning, teamwork, strategic thinking, written and oral communication, and interpersonal skills are on almost every organization's list of required manager skills. These skills are usually defined by listing behavioral statements that exemplify the skill. While these behavioral descriptions are helpful, they must be understood within the rubric of a valid mental process model that identifies the components of performance and the interactions of these components. The mental process model, then, becomes the definition of the skill.

Once the skills are defined as processes, it becomes possible to design diagnostic appraisals that provide information about all the elements of the mental process model required to create individualized, prescriptive development plans. A diagnostic appraisal provides a comprehensive picture of the learner's needs, including information about the correctness of the learner's knowledge structures compared to the knowledge structures of an expert. The appraisal identifies where the learner's skills are on the novice-expert continuum. It identifies whether the learner is at the declarative knowledge or knowledge compilation stage for the skill. The appraisal also provides similar information regarding the executive control processes. Finally, the appraisal assesses the learner's self-efficacy for the skill domain and related skills, actions and responses that might be required.

As is the case with the appraisal, the design of training must be informed by the mental process model. The training developer has a psychological obligation to be able to structure that instruction. The instruction must be designed because, for each learner, there is a unique set of elements that must be addressed in the instruction must be able to address.

Additional Considerations: Appraisal-Development

There are other changes that the performance appraisal and development process would entail, such as the following:

Manager and Employee Coaching

Coaching skills are now a basic managerial training program we will emphasize in the management development program. We will place more emphasis on mentoring roles prior to assuming full responsibility in order to develop organizational depth in employee development. Effective manager development in many managerial circles means development of management selection has been attempted to evaluate candidates.

As so many have noted (for example, the protean worker. In the 20th century, managers had the responsibility for their own career planning and development. Today, managers need to appreciate that some of the individual differences in job satisfaction, stress, career progression, and such critical moderators of the performance evaluation and actual learning.
The increasing use of competency assessment pushed back from outputs to inputs to the competencies that target competencies used in one artifact of that organization's competency model. The notion of appraisal being pushed back to individual's current skill level in theory around the notion of strongly that to diagnose and support merely to ascertain the needs and need improvement, rate. A finer level of analysis is maintained in appraisals. For existing, decision making, planning, work, strategic thinking, interpersonal skills are on a manager's skills. These skills are exemplified by statements that exemplify options are helpful, they must be. A valid mental process model is then the interactions between processes, it becomes possible to acquire information about all the elements required to create individuals. A diagnostic appraisal process learner's needs, including the learner's knowledge of the expert's structures. The learner's skills are on the novice level, the learner is at the declarative stage for the skill. The nation regarding the executive appraisal assesses the learner's self-efficacy for the skill domain and other social-emotional reactions and responses that might facilitate or inhibit learning.

As is the case with the appraisal, more finely defined skills enable the design of training programs that address all elements of the mental process model. Armed with a valid model, the course developer has a psychologically sound basis on which to build instruction. The instruction must address all elements of the model because, for each learner, the diagnostic assessment will identify the unique set of elements that require remediation and the instruction must be able to address each unique set of remedial needs.

**Additional Consideration for the Appraisal-Development Process**

There are other changes that will influence the future of performance appraisal and development programs. These trends include the following:

**Manager and Employee**

Coaching skills are now a basic element of virtually every management training program we have encountered. Entry-level management development programs commonly have participants take on mentoring roles prior to assuming formal management responsibility. In order to develop both a sensitivity to, and skill at, employee development. Effectiveness as a coach-mentor is an element in many managerial competency models. Not surprisingly, management selection has, in the past decade, increasingly attempted to evaluate candidates on coaching-mentoring skill. Coaches are well positioned to provide developmental appraisals, but few are well equipped to do so.

As so many have noted (for example, Hall, 1996), we live in the era of the protean worker. Employees need to take personal responsibility for their own career development. It is for this reason that some of the individual difference variables (self-efficacy, self-esteem, explanatory style, and so on) we discussed earlier will be such critical moderators of the linkage between appraisal feedback and actual learning.
Interventions

Individual Development Plan

In line with the notion of career self-management, organizations are encouraging the creation of individual development plans (IDPs), at least for professional, managerial, and higher-level sales positions. Sometimes the plan is part of a succession planning program. The IDP document typically lists:

- Competencies that are targeted for development
- Developmental action steps (both formal and on the job) to be undertaken
- Milestones and (more rarely) metrics to assess progress

Organizations vary considerably in what is done with these documents. In most cases, IDPs are developed and reviewed with the individual’s direct supervisor. In other cases, a mentor or field development coordinator out of the training department is responsible for reviewing, approving, facilitating, and tracking the plan. Unfortunately, too often there is little or no personal accountability for achieving or failing to achieve developmental milestones. And, as we have been arguing, even the best IDPs lack the specificity of a well-articulated mental model that would tightly define the targets, methods, outcomes, and mediators for successful learning.

Compensation and Certification

There is much talk of “pay for skills” instead of pay for performance. Some major organizations have selectively established certification programs that reward employees for skill development. One major telecommunications firm, for instance, designed a systematic technical knowledge and skill assessment process for Major Account Representatives, a unionized position. The certification process defined four competency levels from novice to expert. Incumbents went through assessment and received very specific written feedback against the standards for the next competency level. The feedback identified, for example, the particular product or procedure in which competency was at least that required for a Level 1 Representative to be certified at Level 2. Incumbents were entitled to retest for certification at the next competency level every six months. Employees get paid as they certified at higher and higher levels.

Global Needs Identification

Using available information, aggregating data from multiple sources, identify needs common across employee interventions. Rarely, though, does the developmental section of the IDP come from IDPs.

Resources

Organizations run a risk in the future, without also providing appropriate tools and techniques to which employees felt that they were directly affected employee by employee. In turn, this “developmental account” of employees toward the end of the year.

Organizations are beginning to see the link between appraisal and development. Some tools are now organized around the idea of the Successful Manager (Gebelein & Sheard, 1995), with videos, tapes, courses, and on-the-job training to address weaknesses in a specific area. The software is used to diagnose weaknesses and the system provides feedback. From the evaluation research has not yet established the developmental suggestions that emerge in the specific target areas.

Conclusion

In 1978, Glaser stated, “Progress in this field requires a deep integration required for building on research and theory in less than fifteen particular areas that show this is possible.”
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level, Level 2. Incumbents were
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every six months. Employees received compensation adjustments
as they certified at higher and higher levels.

Global Needs Identification
Using available information technology, training departments are
aggregating data from multiscopic surveys and assessments to iden-
tify needs common across employees in order to focus broader in-
terventions. Rarely, though, are similar data aggregated from the
developmental sections of the regular performance appraisal form
or from IDPs.

Resources
Organizations run a risk in providing developmental feedback
without also providing appropriate developmental resources. In
one field study, Maurer and Tarulli (1996) found that the degree
to which employees felt that such resources were available to them
directly affected employee beliefs in their own capacity to improve.
In turn, this "developmental self-efficacy" influenced the attitudes
of employees toward the entire appraisal process.

Organizations are beginning to understand the linkage be-
tween appraisal and development. A number of guides to training
tools are now organized around competencies. One example is the
Successful Manager’s Handbook (Davis, Skube, Hellervik,
Gebelein, & Sheard, 1995), which provides specific resources (books,
tapes, courses, and on-the-job experiences) that are assumed to ad-
dress weaknesses in a specific competency. Several vendors now pro-
duce software in which the user chooses the particular competency
weakness and the system provides developmental suggestions. The
problem with these resources is that a critical mass of systematic
evaluation research has not yet been built to impart confidence that
the developmental suggestions will indeed address particular de-
cencies in the specific target competency.

Conclusion
In 1978, Glaser stated, “Progress is now being made toward the in-
tegration required for building a psychology of instruction based
on research and theory in learning and cognition. Some of the par-
ticular areas that show this interaction include: psychological task
process models. Such a theory in specifying mental processes.

Organizations will not be able to use cognitive theory unless they thoughtfully incorporate the research that is becoming available. An applied research base must be developed using carefully sound methods of diagnosis.

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process models. Such a theory is developing along with advances in specifying mental process models.

Organizations will not benefit from advances in learning and cognitive theory unless they create development programs that thoughtfully incorporate the findings of theory-guided research. An applied research base must be developed to establish empirically sound methods of diagnostic appraisal linked to development.

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