Teacher performance evaluation as structured within a knowledge-based system: a question of feasibility

Lynn Stevenson
Iowa State University

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Stevenson, Lynn, Ph.D.
Iowa State University, 1987
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Teacher performance evaluation as structured within a knowledge-based system: A question of feasibility

by

Lynn Stevenson

A Dissertation Submitted to the Graduate Faculty in Partial Fulfillment of the Requirements for the Degree of DOCTOR OF PHILOSOPHY

Department: Professional Studies in Education Major: Education (Educational Administration)

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Ames, Iowa

1987
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CHAPTER I. INTRODUCTION

Naisbitt states, "We are drowning in information but starved for knowledge" (Naisbitt, 1982). The exponential proliferation of information has produced a need for improved strategies; strategies which will separate and group information to assure that it is delivered in the most efficient way. This "grouping" process, will require that information (in the form of knowledge) be divided into two halves; knowledge requiring memorization and knowledge which can be accessed via a job tool or decision aid (Harmon & King, 1985). Until attention is directed towards the organization and structuring of information, it will remain in its raw form—a useless commodity to society in general.

The Knowledge Explosion

As a result of knowledge classification, the definition of human intelligence will be subject to revision. Psychologists will change the way intelligence is measured. The ability to retrieve stored information will become less of a factor in this new definition of intelligence. Redefinition will include: knowledge of access strategies, decision tools and data bases, as well as the speed with which information retrieval is accomplished (Simon, 1971). The developmental progression leading to this new intelligence, and its inherent processes, resembles more closely than ever, the evolutionary path traversed by computer software.
The mind (or what the artificial intelligence experts would call the "human information processing system") uses a network of associated chunks to store vital data (Harmon & King, 1985). Similarly, computers use schemas to represent knowledge in the form of semantic networks, object-attribute-value triplets and logical expressions. The existence of parallels between these two systems have prompted joint research efforts. Cognitive psychologists and researchers in the field of artificial intelligence have joined forces to work together toward improving the knowledge base within both fields.

### The Representation of Knowledge

Harmon and King, in their recent book *Expert Systems*, (Harmon & King, 1985) have identified five strategies for the representation of knowledge: (1) Semantic networks: a representational scheme using nodes (objects and descriptors), links (illustrating relationships between objects), and inheritance hierarchies (refers to the ability of one node to "inherit" characteristics from another); (2) Object-attribute-value triplets: objects, attributes (a characteristic associated with an object), and values work together to represent factual information; (3) Rules: consisting of a premise (the "if" section) and a consequent (the "then" section); they are used to represent relationships; (4) Frames: representing facts and relationships; and (5) Logical expressions: propositional logic is used in the formation of artificial intelligence systems (Harmon & King,
1985). As research in the area of cognitive processing accelerated, it became evident that its application would address the need for enhanced decision tools—this occurring as an outgrowth of the information explosion. The realization that representational knowledge schemes could be symbolically coded into computer programs with the effect being that computers could emulate human cognitive processing, initiated the birth of artificial intelligence.

As with any field of knowledge still in its infancy, artificial intelligence will acquire an increased sophistication as it matures. Even at this early stage of development it offers designers a powerful new tool with which to experiment. A tool which has proven highly successful in assisting individuals to solve complex, multifaceted problems in an array of areas. This discussion will address the application of artificial intelligence—specifically the area of expert systems design—to the development of a knowledge-based software program structured to assist in the process of teacher performance evaluation.

Teacher performance evaluation is a complex task dependent upon the use of heuristic knowledge. Expert systems provide decision-making aids for problems structured in this manner. The use of expert systems technology to assist in the teacher performance evaluation process is validated by the nature of the problem and the ability of the system to effectively assist in the problem's resolution.
The Nature of the Research

The intent of this project was to perform basic, not applied research. This research attempted to answer some fundamental questions which do not have immediate commercial value or practical application. Of primary interest, was the potential use of knowledge-based systems for the purpose of teacher performance evaluation. To examine the feasibility of using a knowledge-based system, a software program (K-BAS) was designed and tested. As part of the feasibility check, five performance scenarios were developed depicting differing levels of instructional effectiveness. The scenarios were subject to evaluation by two sources: teacher performance evaluators and the assessment algorithm as contained in a knowledge-based system. These data were compiled and analyzed.

The research and development cycle described by Borg and Gall (1983) was used in development of the software program: (1) research and information collecting (including review of literature, classroom observation, and preparation of report of state-of-art); (2) planning (includes defining skills, stating objectives, and small scale feasibility testing), (3) develop preliminary form of product (includes preparation of instructional materials, handbooks, and evaluation devices), (4) preliminary field testing (conducted on a small scale - interviews, observational and questionnaire data collected and analyzed); (5) main product revision (revision of product as suggested by preliminary field test results); (6) main
field testing (conducted on larger scale—quantitative data on subjects' pre- and post-performance), (7) operational product revision (revision of product as suggested by main field-test results), (8) operational field testing (conducted on large scale—interview, observational and questionnaire data collected and analyzed); (9) final product revision (revision of product as suggested by operational field-test results) and (10) dissemination and distribution (report on product, commercial distribution).

Although the entire research and development cycle consists of ten steps, this dissertation will use only the first five processes of the cycle.

This investigation focused on the feasibility of developing a micro-based software program which would assist supervisors in the analysis of teacher performance evaluation data. This examination represented a logical choice, as the investigator has been involved in research efforts focusing on teacher performance evaluation and the role technology plays in this process. This investigation will further these research efforts.

The software program (K-BAS) was designed to provide users with a status recommendation—either promotion, maintenance, probation, or termination—for each evaluated teacher. This recommendation is based upon performance data entered by the user and weighted within a formula or algorithm. The algorithm encapsulates the knowledge of experts in the field of teacher performance evaluation, thus
allowing supervisors access to a resource otherwise not available.

Statement of the Problem

Two complementary problems were addressed within this investigation: (1) the absence of a quantitative method for making judgments in the evaluation of public school teachers, and (2) the lack of sophisticated administrative software programs (in the form of knowledge-based systems) in the public schools. The need for additional research in both of these areas was substantiated by the literature.

Problems inherent within the teacher performance evaluation process as it exists include: (1) numerous variables exist which remain unaddressed or unidentified, i.e., the typical supervisor will fail to take these into consideration unless prompted to do so, (2) these variables deserve different weights—most likely an arbitrary assignment will be awarded each, (3) different decisions will result dependent upon the day or even year in which the data are examined—this type of decision process produces low reliability, (4) some factors are used in the decision process which probably should not be used, e.g., the positive or negative nature of the supervisor/teacher relationship, (5) there are differences in opinions regarding how to weight particular components within the process, i.e., should student feedback be given more weight than that of other administrators (Miller & Hutter, 1983)?

In an attempt to find answers to these problems, a decision-making
model containing an algorithm was developed.

The second problem, that of the lack of sophisticated administrative software programs, is easily defined. Presently, knowledge-based or expert systems programs in any field are virtually nonexistent (J. Mecklenberger, Institute for Transfer of Technology to Education, Alexandria, Virginia, telephone conversation, 1987). In April of 1987, one of the first systems to be operationalized will be introduced at a major convention. This software (entitled "Class LD") will assist in the identification and classification of learning disabled students. Other less sophisticated products have been developed in the areas of negotiations, hiring practices, and student behavior (Human Edge, 1986). There appear to be no expert systems currently available which address the issue of performance evaluation (Mecklenberger, 1987).

**Purpose of the Study**

This study was designed to research two complementary problems; the absence of a quantitative means of making judgments in the evaluation of public school teachers and the lack of sophisticated administrative software programs. Review of the research suggests that by nesting a quantitative decision-making process within a technological tool, efficiency and reliability will increase. K-BAS (Knowledge-Based Assessment System) the software designed from this project, attempts to provide for these positive results.

The purpose of this study was to find answers to these questions: (1) What components does an effective performance evaluation decision-
making tool need? (2) Which data collection sources would be selected by the performance evaluation specialists as critical to the assessment process? (3) How would the weights of components in the data collection sources be distributed by the performance evaluation specialists? (4) How would performance evaluators assess the effectiveness of teachers depicted in the hypothetical scenarios? (5) How would the Knowledge-Based Assessment System (K-BAS) assess the effectiveness of teachers depicted in hypothetical scenarios? and (6) Will the data obtained from the performance evaluators differ from those K-BAS provides?

A second purpose of this study was to continue the work completed by a team of researchers at Iowa State University on the Computer-Assisted Teacher Evaluation and Supervision (CATE/S) (Manatt, et al., 1986) system. CATE/S allows for the storage of teacher performance evaluation data, generation of reports comparing performance across districts, and development of Professional Improvement Commitments. CATE/S is a powerful decision support tool for performance evaluators.

Basic Assumptions

This research has been done within the context of certain assumptions. The veracity of these assumptions will impact results obtained from this investigation. Although each of these assumptions has evolved from a well-established research base, knowledge is of a contingent nature and assumptions made concerning its
reliability must be constantly tested.

The following assumptions have been made: (1) Data collection sources identified by selected performance evaluation specialists are proper; (2) Weights assigned by performance evaluation specialists to components in each of the data collection sources are appropriate; (3) Performance scenarios used to test feasibility of the software depict differing and typical levels of instructional effectiveness; (4) Knowledge-based programs have been developed far enough to be meaningful for application in teacher performance evaluation; (5) Performance evaluation specialists selected to contribute expertise to the knowledge base of the software program have the qualifications to do so; and (6) Administrators assigned to teacher evaluation have the ability to use computer-managed administrative software.

Definition of Terms

Research in the area of artificial intelligence is at an immature stage of development. Vocabulary within the field is in a state of flux (although there does exist a specific parlance for a subsection of terminologies). In an attempt to address this issue, the following section presents key words used throughout this discussion. In other instances, definitional statements have been included in conjunction with text.

Algorithm As defined in expert
systems: a systematic procedure if followed, guarantees a correct outcome (Harmon & King, 1985).

**Antecedent**

The If portion of a RULE that can have either inferred or input attributes (Nagy, Gault & Nagy, 1985).

**Artificial Intelligence (AI)**

Science concerned with the concepts and methods of symbolic inference by a computer and the symbolic representation of knowledge to be used in making inferences (Feigenbaum & McCorduck, 1983).

**Attribute**

An attribute is variously called a variable, or a data element. It is a device for declaring a storage area in the computer memory to which a value or values can be assigned (Nagy, Gault & Nagy, 1985).
<table>
<thead>
<tr>
<th><strong>Backward Chaining</strong></th>
<th>One of several control strategies that regulate the order in which inferences are drawn (Harmon &amp; King, 1985).</th>
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<tr>
<td><strong>Beginners All-Purpose Symbolic Instruction Code (BASIC)</strong></td>
<td>Anabbreviation for Beginner's All-purpose Symbolic Instruction Code (Zwass, 1986).</td>
</tr>
<tr>
<td><strong>Computer-Assisted Instruction (CAI)</strong></td>
<td>The focus is on using the computer as a tutor or for drill and practice activities (Kuchinskas, 1984).</td>
</tr>
<tr>
<td><strong>Certainty Factor</strong></td>
<td>A numerical weight given to a fact or relationship to indicate the confidence one has in the fact or relationship (Nagy, Gault &amp; Nagy, 1985).</td>
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<tr>
<td><strong>Chunk</strong></td>
<td>A collection of facts stored and retrieved as a single unit (Nagy, Gault &amp; Nagy, 1985).</td>
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<tr>
<td><strong>Computer-Managed Instruction</strong></td>
<td>The focus is on the management of the instructional program</td>
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<td>Term</td>
<td>Definition</td>
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<tr>
<td>Computer-Managed Administration (CMA)</td>
<td>The focus is upon the management of administrative functions (Kuchinskas, 1984).</td>
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<tr>
<td>Consequent</td>
<td>The THEN portion of a rule in which an inferred attribute is given a value (Harmon &amp; King, 1985).</td>
</tr>
<tr>
<td>Command</td>
<td>A word in the ACTIONS section that causes the system to provide information to the user (Nagy, Gault &amp; Nagy, 1985).</td>
</tr>
<tr>
<td>Consultation Paradigm</td>
<td>Consultation paradigms describe generic types of problem-solving scenarios (Harmon &amp; King, 1985).</td>
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<tr>
<td>Domain expert</td>
<td>The source of the knowledge upon which the attribute hierarchy and</td>
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<tr>
<td>Electronic Mail</td>
<td>The ability of processors to transmit documents over cables or phone lines (CPT, 1985).</td>
</tr>
<tr>
<td>Expert system</td>
<td>Current usage: any computer system that was developed by means of a loose collection of techniques associated with AI research (Harmon &amp; King, 1985).</td>
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<tr>
<td>Expertise</td>
<td>The skill and knowledge possessed by some humans that result in performance far above the norm (Harmon &amp; King, 1985).</td>
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<td>Fifth-Generation Computers</td>
<td>The next generation of computing machines (Harmon &amp; King, 1985).</td>
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<tr>
<td>Forward Chaining</td>
<td>One of several control strategies that regulate the order in which inferences are drawn (Harmon &amp; King, 1985).</td>
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<td>Frame</td>
<td>A knowledge representation scheme that associates an object with a collection of features (Harmon &amp; King, 1985).</td>
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<td>Heuristic</td>
<td>A rule-of-thumb or other device that reduces or limits search in large problem spaces (Harmon &amp; King, 1985).</td>
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<td>Inference Engine</td>
<td>That portion of a knowledge system that contains the inference and control strategies (Harmon &amp; King, 1985).</td>
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<td>Knowledge Base Author</td>
<td>The person who develops the code for the expert system based on the knowledge available (Nagy, Gault &amp; Nagy, 1985).</td>
</tr>
<tr>
<td>Knowledge Base</td>
<td>The portion of a knowledge system that consists of the facts and heuristics about a domain (Harmon &amp; King, 1985).</td>
</tr>
<tr>
<td>Knowledge Engineer</td>
<td>An individual whose specialty is assessing problems, acquiring</td>
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</table>
List Processing (LISP)  A programming language used by American AI researchers (Harmon & King, 1985).

Menu  A screen format that provides a question with a list of possible answers or values (Shelly & Cashman, 1982).

Modus ponens  A basic rule of logic that asserts that if we know that A implies B and we know for a fact that A is the case, we can assume B (Harmon & King, 1985).

Object-Attribute-Value (O-A-V) Triplets  One method of representing factual knowledge. Describes relationships between knowledge components (Harmon & King, 1985).

Parser  The process by which a knowledge base is both examined for
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<tr>
<td>PROLOG</td>
<td>A symbolic or AI programming language based on predicate calculus (Harmon &amp; King, 1985).</td>
</tr>
<tr>
<td>Protocol</td>
<td>The set of rules governing the operation of functional units of a communication system that must be followed if communication is to be achieved (CPT, 1985).</td>
</tr>
<tr>
<td>Robotics</td>
<td>The branch of AI research that is concerned with enabling computers to &quot;see&quot; and &quot;manipulate&quot; objects in their environments (Harmon &amp; King, 1985).</td>
</tr>
<tr>
<td>Rule</td>
<td>A conditional statement of two parts (Harmon &amp; King, 1985).</td>
</tr>
<tr>
<td>Semantic Networks</td>
<td>A type of knowledge representation that establishes proper syntax, punctuation, keywords, names and storage locations for attributes and their values and their attachments (Nagy, Gault &amp; Nagy, 1985).</td>
</tr>
<tr>
<td>Term</td>
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<tr>
<td>Tool Software</td>
<td>Educational software that helps the user accomplish a task yet does not specify the exact procedures involved in the task. Examples include word processors, data base management programs, spread sheet packages, and statistical packages. (Sheingold, Hawkins &amp; Kurland, 1983).</td>
</tr>
<tr>
<td>User-Friendly</td>
<td>A system that can be used by an inexperienced user with little difficulty (Nagy, Gault &amp; Nagy, 1985).</td>
</tr>
<tr>
<td>Workstation</td>
<td>Computer systems that help a performer do his or her job. Usually consisting of various...</td>
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pieces of hardware often connected to file servers and various data bases (Harmon & King, 1985).

As the amount of information dramatically increases, intuition becomes increasingly valuable, precisely because there is so much data (Naisbitt, 1985). In order to meet the needs of the new information society, AI researchers and cognitive psychologists must continue their study of information processing systems so that programs harnessing the power of intuitive thought can be realized. As initial research efforts establish a more powerful and deep understanding of the field, more effective programming will result. It should not be beyond reason to expect programs which are structured to mimic the cognitive processing structure of individual minds. The ramifications of this accomplishment for educational programming are overwhelming.
CHAPTER II. REVIEW OF THE LITERATURE

Research and development efforts must attempt to provide a means of transition between innovative educational research and current educational practice. In order to achieve this bridge, it is first necessary to understand the present status of the topics being addressed; in this case, teacher performance evaluation and artificial intelligence research. This chapter will outline current research efforts in both of these fields, provide comment on identified problems, and discuss this investigation's rationale.

Teacher Performance Evaluation: The Need for Increased Accountability

A number of national reports have documented the need for increased educational program accountability. Recommendations can be found within: Renewing the Commitment, 1986; Time for Results: The Governors' 1991 Report on Education, 1986; A Nation At Risk: An Imperative for Educational Reform, 1983; Action For Excellence, 1983; and First in the Nation in Education, 1984. Accountability issues have plagued public school officials since the inception of the Latin Grammar School. It seems that during lean economic times, these same concerns receive additional attention by the press. This is not to imply, however, that educators should summarily dismiss purposeful comments from insightful and knowledgeable commission members.
Accountability has many interrelated components—often dependencies exist between what appear to be separate functions. Performance evaluation of teachers is one of the spokes in the accountability wheel which serve to assure positive educational outcomes. Unfortunately, these outcomes are seldom measured in the form of student gain scores. The importance of effective performance evaluation in the production of educational product cannot be ignored. A majority of the reports cited indicate a need for continued refinement of performance assessment practices.

Specific methodological problems exist within the performance evaluation process (unidentified and/or non-weighted variables, low reliability, lack of consensus on data weights, and the use of inappropriate factors). In order to address these issues, research efforts directed at each must be reviewed and analyzed. After establishing a research base, it becomes possible to generate logical solutions. This chapter has been divided into discussions of the major topic areas—teacher performance evaluation and artificial intelligence research. Within the area of teacher performance evaluation, three issues will be reviewed; variable identification and weight, reliability concerns, and confounding factors.

**Variable Identification and Weight**

The majority of research efforts centered on performance evaluation have been directed along a narrow band. Of primary concern has been the identification of specific behaviors which prove
to be valid predictors of instructional effectiveness. Criteria of this type, as illustrated by the Teacher Performance Evaluation Instrument (Manatt & Stow, 1984), provide a reliable tool for supervisors to use. The knowledge base from which these criteria were extracted is broad and interactively related to efforts within the area of effective schools research. Access to a diverse number of models depicting differentiating criteria (Blackmer, Brown, Pinckney & Walker, 1983) afford any supervisor a pool of performance criteria from which to choose. Lamentably, few attempts have been made to assign discriminatory weightings to individual criterion—a mandatory prerequisite for effective evaluation (Manatt & Stow, 1984).

The suggestion here is that, perhaps, by focusing so intently upon definition of performance evaluation criteria, other sources of data which might impact performance evaluation have been overlooked. It is possible to find references within the literature to direct and indirect measures of teacher performance (Millman, 1981), but little attention has been focused upon the framing of interrelationships between data elements or to specific criteria weighings. Using available research, however, it is possible to identify the following data collection sources (Duke & Stiggins, 1986); (1) teacher performance evaluation criteria, (2) anecdotal notations, (3) intervention ratings, (4) achievement data, (5) special conditions data, and (6) performance record. The presence of each of these six data collection sources as active factors worthy of recognition within the
performance evaluation process has been investigated by this research project.

Performance evaluation is affected by an array of criteria—to state that each interacts at the same level of intensity is naive. Additional research focusing on differentiating criteria effect and and, more accurately, identifying the impact of individual data sources should be undertaken (Oliva, 1976). Efforts should be directed towards definition of a balanced set of data capable of producing reliable, valid and legally discriminating teacher performance evaluations (Manatt & Stow, 1984). This investigation has attempted to draft an initial set of data to be used in directing future research efforts.

A large number of performance evaluation criteria has been identified in the literature (Manatt, 1982; Redfern, 1980; Armstrong, 1973; Darling-Hammond et al., 1982). It has been considered sufficient, however, to identify these criteria without assigning any type of a discriminatory weighing to each. Moreover, because of the intent focused upon these criteria, little attention has been directed to the identification or role that other data collection sources might play within the performance evaluation process. This appears to be an area of research in need of additional definition.

Issues Related to Reliability

"There are three eternal quests of mankind; the Holy Grail, the fountain of youth, and the search for a valid and reliable means of
evaluating teaching!" (Popham, 1975). This statement seems to convey not only the enormity of the task that confronts researchers but also its insidious nature. The complex structure of the evaluation process has confounded the efforts of many researchers (Dunkin and Biddle, 1974), but just as many have subjected it to a rigorous examination and emerged with insightful new discoveries.

Teacher effectiveness research efforts devoted to improving the evaluation process have been conducted by such noted scholars as: Rosenshine (1971); Good, Biddle and Brophy (1975); Medley (1979); Manatt and Stow (1984); McNeil and Popham (1973), McGreal (1982); and Bolton (1973). These efforts, and those of others, have allowed the process of performance evaluation to more closely resemble that of a "hard" discipline. Inherent within disciplines functioning with rigid infrastructures, are prescribed terminologies, attributes, rules and protocols which tend to support increased reliability. It can be expected that as research efforts continue, the art of performance evaluation will undergo a transformation—technology may well play an important role in this process. The newly emerging entity will perhaps resemble more closely a science and embody characteristics reserved for disciplines of this nature.

Reliability, as related to performance evaluation, concerns supervisor's ability, given "x" variables, to generate "y" option over repeated trials. An increase in reliability within the performance evaluation process is obviously desirable. Reliability will improve
as a result of identification and use of research-based criteria (Stow and Sweeney, 1981; Bolton, 1980). There is not, however, universal agreement upon which set of criteria produce the most reliable evaluation. There is evidence to support the position that a generic set of criteria will never be defined (Brophy, 1979; Duke and Stiggins, 1986).

Systems which have taken advantage of concisely defined criteria; the Georgia Assessment Project (Capie, 1980), the Florida Performance System (1982), and the North Carolina Teacher Evaluation Project (1983) have experienced improved reliability as an outgrowth. As researchers are able to quantify data contributors to even a greater extent, correlational increases in reliability are to be expected. As research efforts continue to refine the performance evaluation process into a highly articulated system of discriminating criteria (Manatt, Palmer and Hidlebaugh, 1976), even more reliable data will result.

A supervisor's ability to produce more reliable performance evaluations has increased with the improvement of the research base (Lucio and McNeil, 1960; Marks et al., 1971). Initially conceptualized as a rating process using observations and checklists (Redfern, 1973), teacher performance evaluation has undergone a dramatic change. Component skills have been identified by many researchers (Bolton, 1973; Brophy, 1979; Manatt, 1981-1982). The significant increase in research efforts, prompted partially by a demand for increased accountability, has resulted in the emergence of creative systems. The School
has resulted in the emergence of creative systems. The School Improvement Model (SIM) (Manatt & Blackmer, 1980) represents a total systems approach to teacher performance evaluation created from the new evaluation technology. Future research will undoubtedly yield models allowing for even more precise definition of instructional effectiveness as focus is directed towards this end.

Research conducted by the Joint Committee on Standards for Educational Evaluation will also contribute to an increase in the production of more reliable teacher performance evaluations. The Committee is now completing review of the second draft of Standards for Evaluations of Educational Personnel. This resource contains personnel evaluation standards which will provide: an operational definition of personnel evaluation; guidelines for developing evaluation systems, criteria for assessing evaluation systems, plans, and reports; suggestions for strengthening evaluation systems; general principles for settling disputes about personnel evaluation; content for training evaluators; and a conceptual framework for studying personnel evaluation (Joint Committee on Standards for Educational Evaluation, 1987 pending). The present investigation is representative of the type of research currently being completed in the area of evaluation.

The advent of merit pay and the call for increased accountability have prompted the issuance of numerous reports and recommendations. Research efforts have produced creative new strategies and models in
an attempt to address these issues. A heightened awareness among the body politic of these key issues has brought about a commitment to invoke change at both the federal and state levels. Governors in several states are challenging legislators to allocate additional resources to improve the quality of education—often that improvement involves increased reliability in performance evaluation.

Confounding Factors

The literature focusing on teacher performance evaluation indicates a severe deficit of practitioner resources; neither protocol materials or training sessions are widely available. Some of the materials which are in existence reflect criteria specific to state mandates (Georgia Assessment Project, Capie et al., 1980) thereby limiting their use. Manatt lists ten resources in an occasional paper released in 1983 (Manatt, 1983). An ERIC search initiated in 1985 elicited only a limited number of references. Available materials advocate widely disparate philosophies, thereby leaving supervisors to determine (at their own risk) the really significant bits of information. Uniformity and availability are needed within this area. Teacher performance evaluation is a skill requiring training for improvement (Manatt, 1982). Resource materials facilitative of this must be accessible.

The use of effective resources, such as the Teacher Performance Evaluation (TPE) component of the School Improvement Model Projects (Manatt, 1982) has resulted in the improvement of performance evalu-
tion skills. Interrater reliability (a predictor of discriminatory power) among participants exposed to their first TPE training session is extremely low (Harrington, 1984). It is not until the third day of training, after intensive programming directed towards the improvement of evaluatory skills, that interrater reliability increases.

As suggested earlier, performance evaluation is a complex process composed of an array of criteria—mastery of a skill of such intense structure requires repeated practice and directive feedback. It is imperative that research efforts result in the design and development of better and more resource materials to assist supervisors in the improvement of assessment skills.

Summary

Members of key governmental committees and commissions would assert that some educational administrators have abrogated their responsibility to insure the educational growth of many young minds by not addressing the issue of teacher performance evaluation. Although more research has been directed to examination of this important function, answers to essential questions remain unanswered. There is evidence to suggest that increased reliability can be attained through further definition of integral factors within the performance evaluation process and with the development of intensive retraining programs for supervisors.

This investigation attempts to address those issues previously identified through effecting integration of educational components and
technological expertise. Education and technology must find a way to coexist, each complimenting the efforts of the other. Technology functions to enhance educational effectiveness and education functions to allow technology purpose.

The integration of the two should lead to increased educational productivity. It would be ill advised to walk to a site chosen for a vacation (were it any distance) when driving is an option, for by the time the destination was reached, it would most certainly be time to return home without reaping any of the benefits usually accrued on a vacation. So it is with education; why should progress be maintained at a slower, less efficient pace, when there exists the option of traveling at speed with increased effectiveness? This, then, is the cornerstone upon which this investigation's efforts reside.

**Artificial Intelligence**

As previously discussed, the intent of this project has been to find a compatible means whereby teacher performance evaluation and technology could be interrelated. Review of the Literature related to artificial intelligence produced support for this liaison. In the ensuing sections, these topics will be reviewed; educational environments of the future, artificial intelligence: definitional status and historical evolution, expert systems/knowledge systems, programming options and future directions for knowledge systems.
Educational Environments of the Future

In order to understand the role that artificial intelligence will play within future educational environments, it is necessary to first understand the environment and the forces which impact it. In this section, discussion will focus on technology and its allure for educators, newly conceptualized educational environments, and an investigation of new products.

The promise of technological transformation in educational systems appears unparalleled. Multiple reasons exist for the pursuit of technological advancement. As discussed in *New Technologies* (N.S.B.A., 1985), a series of "trends" in the areas of economics, demographics, employment, and education give impetus to reformation movements. A constant acceleration in the rate of change within economic, political, and demographic sectors of the macroenvironment mandates responsiveness. Continued bureaucratic entrenchment will lead to further declines in productivity, disillusionment from educational consumers, and decreased cost effectiveness.

Economic considerations prompting the technological revolution cannot be ignored. Recent research indicates that the average cost of classroom instruction in public elementary and secondary schools is $1.25/student/hour; equivalent computer-based instruction costs $1.10/student/hour. The gap between these two costs will continue to widen as the costs associated with public education are steadily rising while computer technology becomes less expensive. Telecommuni-
cations provide an even more cost efficient delivery mode. Educational programming such as **Sesame Street** can be provided for one cent per viewer per hour (Perelman, 1986). With total spending for public education surpassing $300 billion dollars a year and the Gramm-Rudman-Hollings law mandating fiscal austerity, the cost effectiveness afforded by the use of technology cannot be ignored.

The geometric growth of knowledge is dramatically reducing the "occupational half-life" or length of time one's knowledge is useful within a work environment before obsolescence occurs (N.S.B.A., 1985). One generation ago, skills and training obtained through education would assure an individual employment for a period of fifteen years without additional training. Now, reeducation and retraining programs must be undertaken every five years to accomplish the same level of expertise. It is conjectured that individuals entering the job market today will change occupations three times and jobs six times during their work life. This stark reality serves to further reinforce the need for the establishment of effective educational environments.

Only by utilizing available technological products will future educational systems be able to meet the demands of the new information society (Naisbitt, 1982). Increased productivity is dependent upon efficient and effective program components. An analysis of 169 research studies at four educational levels found that computers provide increased instructional effectiveness. Students receiving computer-assisted instruction (CAI) scored significantly higher on
standardized tests than did their counterparts who received conventional programming (Kulik et al., 1983).

Additional studies directed towards determining the potential of microcomputer education (Hargan, Hibbits & Seidel, 1978; Hassell, 1982; Hopmeier, 1982; Hines, 1983; McDonald, 1983; Pitschka & Wagner, 1982) have found: increased achievement; attendance rates to be influenced favorably; an increase in the rate of learning; young boys to improve in reading as much as young girls; and an increase in socialization. These data, as well as those compiled by the Resource Information Service (RIS) of the Association for Supervision and Curriculum Development, indicate positive consequences result from the use of microcomputer programming.

Not all the research related to technology in education is as positive. Three critical problems have been identified: (1) The use of ineffectual software programs; (2) The failure of educational systems to integrate computer learning; and (3) The inability of software programs to provide "high touch" to a society of learners in dire need.

Some educators have either granted computer software programs dispensation from critical evaluation or have not developed the required skills to complete such a review. As a result, the use of ineffectual software in educational programming is far too prevalent (Kuchinskas, 1984) primarily as a result of developmental flaws, software programs failing to: (1) allow for user-initiated pacing,
(2) be error free, and (3) provide immediate correction for inaccurate user responses have found their way to the media center's floppy disk library.

There is nothing magical about software programs; the qualifications of the author as well as the instructional merit of using a specific program need to be determined prior to use. Bonham (1983) states that only a few good learning programs are being developed. Bonham (1983) has suggested that a national effort is needed to assure the development of quality software. The use of ineffectual software will detour educational progress—not assist it.

Another problem, related to the use of computers in education, centers on implementation strategies. Computers in education have been primarily used for drill and practice activities (N.A.S.S.P., 1986). It can be surmised that this narrow use is a direct result of inadequate funds being available for the provision of inservice programming for those employees given the responsibility of implementation. Used in this manner, the ability of computer software programs to impact educational outcomes is significantly limited.

To fully use the potential inherent in software programs, computers will need to be integrated throughout educational systems (N.A.S.S.P., 1986). Few attempts at computer integrated instruction have been made even though this represents the most effective use of software programs. Until more appropriate schemas for computer use are incorporated, it is doubtful that dramatic gains in achievement
directly credited to the use of computers will be realized.

The third, and perhaps most widespread criticism of computer use in education, concerns the loss (due to extensive computer exploitation) of what has been termed "high touch" instruction. The focus of this concern is on use of the computer in lieu of the classroom teacher. It is thought to be dehumanizing to allow software programs to replace actual human interaction. Educators given the responsibility of promoting affective growth are often proponents of this criticism.

No doubt the same charge will be leveled at the use of artificial intelligence for appraisal decision-making. The advent of artificial intelligence has served to initiate even more provocative conversations concerning the essence of "humanness." Critics question whether attempts to replicate human intelligence should be made. It is proposed that as sophistication in the field increases, there exists the possibility of machines keeping humans as pets (Witt, 1986). As a contradiction to this type of thinking, IBM Corporation developed an advertisement campaign containing statements such as "Machines don't think, people do" (Van, 1986). As artificial intelligence becomes more prominent in business and education alike, additional debate about its merit can be expected. It's also important to note that performance appraisal is a very controversial topic. Both of these sensitive issues are intertwined in this dissertation.
Attempts to draw definitive conclusions either in support of or negating the impact of artificial intelligence or computer use in education would be premature. Longitudinal studies in a wide variety or areas need to be completed. As additional studies are completed and statistical data compiled, more significant information will be available for assessment purposes.

Technology exists to increase the productivity of the learning process (Perelman, 1986). As the speed of processing become less of a constraint, "we will have the freedom to present ideas, concepts, techniques, and a richness of information impossible by conventional methods" (National Task Force on Educational Technology, 1986). Advent of the "touch screen," a device allowing the user to suppress a section of the CRT to perform a desired function, can be seen as one of these revolutionary advances.

Several reports, some noted during an earlier discussion on performance evaluation, have addressed the issue of high technology implementation strategies for school districts. Recommendations emanating from two of these reports—Transforming American Education: Reducing the Risk to the Nation and Time for Results: The Governors' 1991 Report on Education—are as follows: Research should be conducted in an attempt to improve traditional delivery methods by maximizing the use of technology-based education. This new configuration should involve the purchase of hardware and software as well as the development of student work-
stations. A caveat contained within *Transforming American Education: Reducing the Risk to the Nation* addresses supervision. Crucial aspects of school management such as planning, finance, teacher education, curriculum development, and instructional effectiveness should be monitored as the interface with technology-based educational practices evolves.

Throughout technologically-related research, discussion is provided on roles, responsibilities, system parts and functions which might be found within the learning enterprises of the future. Many commonalities can be found within investigative studies into technological transformation. An examination of these environmental portraits reveals:

'Teachers will evolve into managers, facilitators, producers of products and processes (NSBA, 1985).

'Curriculum: Integrated curricula responsive to the economic, social, and cultural needs of the developing society will dominate. An instructional management system which allows each student's progress to be monitored and assures that only the student's native potential limits mastery of subject matter will be mandatory. Systems which diagnose learner problems and through an interactive mode provide corrective intervention will be required essentials (National Task Force on Educational Technology, 1986; Perelman, 1986) (Appendix A).

'Facility design: Individual student workstations complete with videodisc player, twelve-inch monitor, and 20 megabyte
microcomputer networked with a file server will be standard equipment. The facilitator's unit will have an optical mark reader, file server, printer and modem (Holden, 1986) (Appendices B and C).

'Information: A massive linkage of databases and sites using telematic technology will allow for information exchange, surrogate travel and interactive communications. The system will link home to school as well as to office and factory (NSBA, 1985) (Appendices D, E, and F).

'Teaching methods and populations: Instruction will focus on learning how to learn rather than assimilation of information. Instruction will be provided to school-age and life-long learners working on varied learning packages in different places at different times (NSBA, 1985).

Promotion will not be predicated upon time-in-grade but will be determined by mastery of stated objectives (National Task Force on Educational Technology, 1986). Knowledge differentiation will allow for increased efficiency in educational programming. Rote memorization will be required for only basic structural frameworks which must be readily accessible (Appendix G). Most knowledge will be attained through access to tools, decision-making aids, or database networks (Harmon & King, 1985).

It becomes apparent that educational environments will be focusing on the provision of individualized programs nested within
superstructures affording lean efficiency. Also vividly evident is the interdependency of component system parts. Technological transformation will require a total systems approach to assure the desired outcome. Productive innovation in any one component of a system mandates modification of the entire system. The principal problem technology confronts within education is that of systems design and integration. Dr. Lewis Perelman, undoubtedly one of the most creative and insightful commentators on technological transformation, cautions that it will not be enough to simply "add on" technological tools.

To attain the productivity demanded by consumers of the educational enterprise and touted by the "third wave" of educational reformists as the only means of salvaging public education; education will need to move away from the socialized bureaucratic function that it is today and begin to develop into a competitive learning enterprise. "The nation that is the first to adopt a high-technology, consumer-based learning system will enjoy a permanent competitive advantage in the global economy of the information age" (Perelman, 1986).

Some of the products which will dominate this new educational environment have already emerged. Others will develop in response to the demands of differentiated programming and creative structural networks. Interdisciplinary teams of subject experts, classroom teachers, learning theorists, and computer scientists will
work collectively toward the development of such products (National Task Force on Educational Technology, 1986).

CD-ROM (compact disc read only memory) applications appear particularly amenable for use within education (Hurley, 1986). One compact disc can hold as much information as 1500 floppies. This increase in storage capacity allows for projects such as Grolier's Electronic Encyclopedia—a 21-volume encyclopedia available on one compact disk. One disk could also hold all of the required textbooks for four years in college. CD-ROM technology is of such recent release, that at this date there are only an estimated 50 CD-ROM packages available. The dynamic power afforded software packages using this format will unfold as product sophistication increases.

Social, economic, and technological trends are providing the impetus for the learning technology revolution. The post-industrial economy has many new and diverse needs which a more competitive educational enterprise will be mandated to meet. Technology will provide the tools to insure increased efficiency, effectiveness, and productivity.

Artificial Intelligence:

Definitional Status and Historical Evolution

In the first section, a review of imperatives mandating the need for educational responsiveness was presented; a textual visit to educational environments of the future was conducted and an examination of potential educational tools was provided. It is these tools
that will provide educators with the means to increase both productivity and accountability. These "electronic blackboards" will assume many forms and perform a variety of functions. It has been argued that, perhaps, artificial intelligence is only a high level tool (Mecklenburger, 1987). Future research projects will have to address this issue as applications of the technology permeate educational environments.

Recognized as an integral partner in the creation of enhanced instructional technology and the provider of increased educational productivity (NSBA, 1985; National Task Force on Educational Technology, 1986), applications of artificial intelligence will become commonplace. Products unlike those previously available will emerge; they can be expected to receive mixed reviews. The unique format used within the artificial intelligence architecture will produce volatile social issues which will require quick address (Harmon & King, 1985).

A review of the literature yields the following definition of artificial intelligence:

Artificial intelligence is an interdisciplinary branch of computer science. It is concerned with developing computer systems which can solve problems in a manner that would be considered intelligent if performed by a human being (Feigenbaum, 1987).

Artificial intelligence can be divided into three research areas; (1) Natural language processing: focuses on the development of computer programs that can read, speak, or understand conversational
language, (2) Robotics: focuses on the development of visual and tactile programs that will allow robots to experience changes within their functional environment, (3) Expert systems (knowledge systems): focuses on the development of computer programs that use symbolic knowledge to simulate the behavior of human experts (Harmon & King, 1985).

Artificial intelligence is the overarching umbrella under which natural language processing, robotics, and experts systems reside. In the present research, the subsection of expert systems will be examined in-depth. This, however, is not meant as a dismissal or diminution of the importance of the other two areas. Educational environments of the future will house all forms of artificial intelligence products.

As recently as 1980 (Appendix H), knowledge-based systems research was confined to university laboratories. Initial research efforts focused on generic problem-solving techniques. The developmental process was slow and cumbersome because encoding program structures was a tedious process. Within the last fifteen years, research focus has shifted to the building of systems containing large amounts of specific knowledge about a particular problem (Harmon & King, 1985). This new emphasis has been considered a major breakthrough in research design.

Initial system development required the use of a programming language called LISP—a high level language consisting of operators
that facilitate the creation of programs that compute with symbolic expressions rather than numbers. As research efforts advanced, "shells," knowledge system building tools, and expert systems generators were developed to assist in the creation of knowledge-based systems. These tools, by simplifying the process involved in the design of a system, made program development available to a new group of "explorers."

In the parlance of the field, knowledge system designers are called "knowledge engineers" or "knowledge base authors (KBA)" (Harmon & King, 1985; Nagy, Gault & Nagy, 1985). A knowledge base author may or may not be an expert in the area in which design efforts are undertaken. It is the primary responsibility of the knowledge base author to write logical rules which incorporate personal expertise or knowledge acquired from an outside source (Nagy, Gault & Nagy, 1985). Care must be exercised in program development to avoid errors in logic translations which could result in disastrous consequences.

**Expert Systems/Knowledge Systems**

The term "expert systems" will be used in the text of this discussion to reference large-scale systems. In contrast, "knowledge systems" will reference small-scale efforts usually containing 200 rules or less. The software designed for this dissertation, K-BAS, is classified as a knowledge system because of the number of rules incorporated within its knowledge base. This is not a static assignment, however, because most knowledge systems structured somewhat
differently can evolve into expert systems.

The literature defines expert systems as follows:

...an intelligent computer program that uses knowledge and inference procedures to solve problems that are difficult enough to require significant human expertise for their solution. Knowledge necessary to perform at such a level, plus the inference procedures used, can be thought of as a model of the expertise of the best practitioners of the field.

The knowledge of an expert system consists of facts and heuristics. The "facts" constitute a body of information that is widely shared, publicly available, and generally agreed upon by experts in a field. The "heuristics" are mostly private, little-discussed rules of good judgement (rules of plausible reasoning, rules of good guessing) that characterize expert-level decisionmaking in the field. The performance level of an expert system is primarily a function of the size and the quality of a knowledge base it possesses (Flegerbaum, 1987).

An expert system consists of six components: (1) Input: This component consists of two parts; user responses to questions from the expert system and user commands to the expert system, (2) Output: Output can take one of three forms; questions to elicit information from the user about problems, useful information for the user (such as steps to take for problem resolution), and responses to commands from the user, (3) User Interface: A translation device whereby the contents of the knowledge base are placed within a language the user can understand, (4) Inference Engine: This component combines the user's answers to questions with rules in the knowledge base. The system then determines which rules are satisfied and which consequences are true. Through this process, the system is able to reach and justify conclusions. Reasoning or logic processes (i.e., forward chaining, backward chaining, certainty
factors) are used to determine with greater precision if rules are to "fire" or not, (5) Knowledge Base: This sector contains the rules developed by the knowledge engineer. There are many strategies for representing knowledge (semantic networks, object-attribute-value triplets, frames, logical expressions) within the knowledge base. Program design will dictate the most effective strategy for the knowledge engineer to use, (6) Parser: This component acts as a transformer; it takes the rules and processes them so that they are in acceptable form for the expert system generator (Harmon & King, 1985) (Appendix I).

Expert systems provide many benefits not found in conventionally programmed packages. The most important of these being; (1) expert systems allow for formalization of expertise, thereby allowing a user organization's intangible assets to become tangible (Harmon & King, 1985). (2) Increased equity will be achieved through the use of expert systems as they provide for a distribution of expertise and knowledge. In an information society where knowledge equates to power, this factor alone validates their existence (Perelman, 1986). (3) Expert systems provide for constant, uniform, and timely assistance (Harmon & King, 1985). K-BAS capitalizes on this benefit by affording supervisors ready access to the pooled expertise of performance evaluation specialists.

Applications of expert systems can be found in both the private and public sector. Most existent systems still reside within the confines of university laboratories, but a few have made the transition
into corporate America. Summarized below are some of the more ambitious systems:

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DENDRAL</td>
<td>Identify chemical compounds from mass spectra data.</td>
</tr>
<tr>
<td>CADUCEUS</td>
<td>Medical diagnosis.</td>
</tr>
<tr>
<td>PROSPECTOR</td>
<td>Evaluate geology.</td>
</tr>
<tr>
<td>MYCIN</td>
<td>Medical diagnosis program for bacteremia and meningitis infections.</td>
</tr>
<tr>
<td>DRILLING ADVISOR</td>
<td>Advise oil drilling crews about problems.</td>
</tr>
<tr>
<td>DELTA/CATS-1</td>
<td>Diesel-Electric Locomotive Troubleshooting Aid (DELTA).</td>
</tr>
<tr>
<td>STEAMER</td>
<td>Teach Naval officers about the problems of running a steam propulsion plant.</td>
</tr>
</tbody>
</table>

**Programming Options**

Many programming options exist for educators desiring to create software. Advancements in the development of new languages such as KAMMAND (Howard Kale Educational Foundation, 1987) and TUTOR (University of Illinois, 1979) as well as the advent of authoring systems serve to simplify the design process. Previously, a neophyte software author would need to master the intricate coding commands, statements, and functions of the language chosen for programming. It is now possible to develop and operationalize a program with a minimum amount of knowledge about programming (Howard Kale Educational Foundation, 1987).
It is estimated that within the next two years, voice-activated program design will be possible, (R. Decker, Department of Educational Administration, University of Northern Iowa, Cedar Falls, Iowa, telephone conversation, 1987), thus bringing the creation of new programs to even the most novice user. These changes will obviously impact educational environments as a proliferation of institution-specific software packages begin to emerge.

It is not the intent, at this point in the discourse, to provide a technical delineation of specifics involved in the evolution of this investigation's software program. It is, however, necessary that fundamental principles of program design and development be understood. The literature provides a means for pursuing this understanding. Although variations exist in terms of definition, the following programming techniques are generally agreed upon (Zwass, 1986; Nagy, Gault & Nagy, 1985; Shelly & Cashman, 1982).

**Analysis of the problem**

It is imperative that the problem to be addressed receive thorough analysis. This process involves an incremental disaggregation of all key elements—an autopsy of the problem's solution. Refined analysis of the problem facilitates completion of the design process.
Design of the algorithm

An algorithm specifically outlining the solution to the problem must be developed prior to coding. The algorithm must present a series of sequential steps which, when carried out, will produce (infinite time) the solution to the problem.

Programmers use tools to depict the algorithm structure. Two types of tools, flowcharts, and pseudocodes have been used for the present research (Appendix J). Flowcharts use specific graphic symbols to represent a variety of functions. One program can contain a series of flowcharts depicting subroutines nested within the main program. If the program does consist of a series of subroutines, a program structure chart is developed to display all modules within the entire program.

Pseudocode, a structured textual description, assists the programmer by identifying some of the control structures which the program will contain. As with flowcharting, one program can be represented by both pseudocode for each subroutine and for overall program structure.

Coding or implementation

Computers are machines that manipulate symbols. The algorithm which has been developed by the programmer must be translated into a code which the computer is able to understand. Many different operating systems exist. The computer languages associated with each of these systems lie on a spectrum that ranges from machine
instructions through intermediate languages. Languages are referenced as low, high or intermediate dependent upon the complexity of the constructs incorporated into them. High level languages useful for numeric programming include: BASIC, C, PASCAL, COBAL, and FORTRAN. An entire group of languages - all derivatives of LISP - is associated with programming efforts within the area of artificial intelligence. These languages allow the design of programs which can manipulate logical expressions and process symbolic information.

Programming environments represent the next level of sophistication in the world of languages, tools, and systems. This prewritten code allows the programmer to access "libraries of subroutines" (Nagy, Gault & Nagy, 1985) designed for particular programming tasks.

Knowledge systems are currently at the pinnacle of the programming hierarchy. Knowledge systems incorporate strategies for inference, representation, and control. They provide a framework for development of knowledge-based systems without encumbering the author with use of complex control structures. Knowledge systems have prompted design efforts from authors previously unable to program their ideas.

Knowledge-based systems require three categories of code; (1) definition of the attributes (variables or data elements), (2) rules to enable the system to give advice, and (3) actions to direct the system. Each of these three components have specific rules governing their development. Format, presentation, and order are rigidly mandated (Nagy, Gault & Nagy, 1985).
Verification

After the program has been coded, debugged (a process allowing for the removal of syntax and logic errors) and entered into the system, it will be subject to repeated execution. The programmer will insert prepared test data to assure operational stability.

Once the program has successfully passed all of the designed tests and detectable errors have been corrected, its documentation must be completed. The documentation is a set of materials which explain the problem being addressed, the program developed to address it, and the program's operation (Zwass, 1986). Typical pieces of documentation include: (1) the analysis and design specifications, (2) a listing of the appropriately commented program, and (3) a set of sample inputs with their corresponding outputs (Zwass, 1986).

Programming involves a series of complex and very structured steps. Analysis of the desired outcome provides the programmer with direction for program design. The complexity and type of problem being addressed dictate the option selected.

Future Directions

A review of related literature reveals few expert system applications within the field of education. One project, DEBUGGY, a system currently being developed at the Xerox Palo Alto Research Center, functions under the assumption that a student's errors in solving problems represent "bugs" and that a discrete modification to
correct the bug in the student's procedures will result in improved behavior. DEBUGGY has been used with groups of students to find systematic errors in the domain of place value subtraction. Through a detailed cognitive analysis of the types of errors students make, DEBUGGY offers corrective programming (Harmon & King, 1985).

Knowledge engineers are attempting to develop systems which can model the user: DEBUGGY is an effort directed towards that end. If systems can be developed which model user processing modes, the system can constantly modify its instructional intervention such that it offers the most effective programming possible. The Prescriptive Program Plans suggested within the treatise on Cognitive Processing Centers (Appendix A) use this powerful processing option. The program plans are structured to change principal goals and objectives as they interactively access databases. Program plans may be expected to undergo radical realignment to reflect instructionally significant trends which would produce desired educational outcomes.

Student workstations were briefly discussed in preceding text. Intelligent workstations can already be found in business settings. A workstation can provide: (1) a listing of the user's principal responsibilities, (2) advise on special problems which might be encountered by the user, (3) quick "checks" on system functions; status determinations, (4) electronic notification to others on the system, (5) selective scanning of pertinent databases and the development of reports based on these data for the user, (6) evaluation
of the impact of an anticipated change in the system prior to introduction of the change, (7) reindexing and cross-referencing of files, (8) a series of expert systems which can be used for consultation (Personnel Advisor, Coaching Advisor, Financial Advisor, ...), and (9) bulletin board access and networking capabilities. Harmon and King (1985) contend that intelligent workstations will revolutionize the work environment. Outcomes resulting from access to a system of this type include: (1) improved supervision of the workforce—it is possible to more closely monitor aspects of employee performance, (2) enhanced decision-making—by access to databases and to others within the field, (3) more efficient program management, (4) increased production, and (5) increased economic stability.

Conclusions

This literature review on artificial intelligence has been purposefully wide in scope. Some of the information presented is of such new origin that it must remain subject to continued examination until a greater depth of understanding can be achieved. The contingent nature of this information demands that caution be exercised in use.

Throughout this chapter, two topic areas have been discussed; teacher performance evaluation and artificial intelligence. Evidence has been provided which suggests that the performance evaluation process, which vastly improved in recent years, must be made more valid. It has been proposed that by identifying and weighing key variables within the process (in essence quantifying qualitative data)
increased validity will result. Further examination of the literature suggests that the most effective structure in which to manipulate these quantified data is that of an expert or knowledge-based system. Part of this assertion results from research indicating that users of computerized information systems are more confident about their decisions (Shangraw, 1986). The placement is also validated by operational aspects of this application.

A second theme in the literature was the urgent need for educators to respond to the beckoning of technological applications. Productivity and accountability in school management could be dramatically increased through the use of expert systems and other technological tools. The product developed within this project (K-BAS), was done so in response to a felt need to expose the educational community to the power and effectiveness of this newly released technology as well as to provide an application of a meaningful nature.
In preceding chapters, much time has been devoted to establishing the cognitive foundation upon which this research rests. Discussion in this chapter will focus on the developmental process undertaken during product design. A methodological outline is presented; starting with analysis of the problem and ending with critical observations.

**Analysis of the Problem**

**Teacher Performance Evaluation**

Research in the area of teacher performance evaluation indicates the absence of a clearly defined set of data collection sources for use during the completion of teacher performance. A supervisor charged with the responsibility of completing a summative evaluation is in need of substantive data illustrative of teacher performance in all instructionally related situations and activities. The low reliability evidenced in evaluations performed by multiple evaluators would seem to be in part a failure of the system to provide valid and standardized data collection sources. The initial task undertaken in this research was the identification of a pool of possible data collection sources for use by supervisors during completion of the summative evaluation.

Archival data play an important role in teacher performance evaluation. During the performance evaluation cycle, defined
by a team of researchers at Iowa State University (Manatt, 1982) as: (1) preobservation conference; (2) observation(s); (3) post-observation conference; (4) evaluation report; (5) professional improvement commitments; and (6) monitor and recycle, many opportunities are afforded for the collection of data. In this research, it was imperative that the most discriminating sources of data be chosen for inclusion in the assessment process. To assure that this occurred, potential data collection sources identified from the literature were reviewed by a jury of performance evaluation experts.

To develop the assessment system outlined in this dissertation, it was necessary to identify categories and classifications in each of the data collection sources. The literature on teacher performance evaluation provided viable designations. In a data collection source such as teacher performance evaluation criteria, an instrument was selected in lieu of pooling a bank of behaviors. The instrument provided the classifications for that particular data source. Other data collection sources required definition of variables or criteria which would help define them more concisely.

After appropriate labels were provided for each category or classification in all data collection sources, a questionnaire containing these statements was designed. To assure clarity, definitions were provided for each of the proposed data collection sources. Because the purpose of the questionnaire was to obtain information from performance evaluation experts which would be used in the
formation of a knowledge base, the questionnaire was entitled—Knowledge-Base Design Tool (Appendix J).

Performance evaluation experts

To obtain validation of proposed data collection sources and classifications in each, a jury of performance evaluation experts was needed. Four researchers (from the east, west, and midwest) whose interests focus on the area of teacher performance evaluation were contacted by letter (Appendix K) and asked to provide a list of individuals they considered experts in the field. These scholars, Ron Brandt (Editor, Educational Leadership), Dan Stufflebeam (Chair, Joint Committee on Standards for Educational Evaluation), Ron Beck (Editor, Performance Assessment: Methods and Applications) and Edwin Bridges (Author, Incompetent Teacher) suggested eighteen individuals.

Knowledge Base Design Tools and an introductory letter (Appendix L) explaining the research were mailed to each of the eighteen identified performance evaluation experts. Responses were obtained from the following: Tom McGreal, Ben Harris, Barak Rosenshine, Wilbur Brookover, Jane Stallings, Shirley Stow, Richard Manatt, Stan Ahmann, Ed Kelly, and Judith Lanier. It must be powerfully emphasized that responses received from these individuals were pooled and averaged. In this manner, philosophic differences between individuals are lost in the collective sum. The end product represents a group consensus on selected items and weights assigned to data.
Data Analysis Process

Responses provided by the jury of performance evaluation experts allowed for the validation of six data collection sources. No sources, other than those proposed, were suggested by more than half the respondents—the criterion level established for inclusion. Original classifications and categories in data collection sources were validated in this same manner. Specific data related to both of these issues are represented in Chapter IV.

In order to quantify performance evaluation data, an algorithm, a recursive computational procedure, was selected to encapsulate the expert knowledge obtained from the performance evaluation specialists. The algorithm was designed to contain codified variables represented as: (1) AGS = the aggregate summative rating produced from each data collection source; (2) W = weight assigned to each data collection source; (3) TWC = the total weighted calculation; obtained by summing aggregate totals multiplied by their respective weights; (4) TPEC = teacher performance evaluation criteria; (5) IR = intervention ratings; (6) SAD = student achievement data; (7) SC = special conditions; (8) AN = anecdotal notations; and (9) PR = performance record.

Once data collection sources and their integral classifications had been identified, the process of determining appropriate weights for each was undertaken. As suggested in the research, each of these data sources can be expected to interact in a distinctive manner and impact in a unique way the performance evaluation process. The
algorithm was designed to reflect differences between the six data collection sources by the assignment of a weight to each. Data obtained from specialists in the field of performance evaluation were used to determine appropriate data weights. The resultant equation was:

\[(TPEC\ AGS)\ (W) + (IR\ AGS)\ (W) + (SC\ AGS)\ (W) + (PR\ AGS)\ (W) + (SAD\ AGS)\ (W) + (AN\ AGS)\ (W) = TWC\]

The algorithm components can be described as follows: (1) \((TPEC\ AGS)\ (W)\) Each of the twenty teacher performance evaluation criteria has been weighted. The user will insert a performance rating (one to five) for each of the twenty criteria. This rating is multiplied by the weight assigned to the criterion. The aggregate sum is composed of all twenty criteria weights multiplied by their assigned ratings. This sum is multiplied by the weight assigned to the data collection source. This weight represents the impact of the data collection source, when compared to the other five sources, on the assessment algorithm.

(2) \((IR\ AGS)\ (W)\) Intervention ratings, i.e., job targets, suggested strategies, etc., can be either positive or negative in their outcome. The aggregate sum for this data collection source consists of the number of attempted interventions multiplied by their outcomes—was an expected objective achieved. This aggregate sum is multiplied by the weight assigned this data collection source in the total algorithm.

(3) \((SC\ AGS)\ (W)\) Each special conditions datum is weighted. The aggregate sum represents the total of those special conditions weights.
This sum is then multiplied by the weight assigned to this data collection source in the total algorithm.

(4) (PR AGS) (W) The performance record aggregate sum is composed of data weighted by its year of origination and by its status—was the evaluation positive or negative. The aggregate sum for this data collection source is then multiplied by the weight assigned it in the total algorithm.

(5) The aggregate sum for the data collection source student achievement data consists of a weighted score entered by the user. This sum is multiplied by the expert defined weight for this data collection source in the total algorithm and

(6) The aggregate sum for the data collection source anecdotal notations is calculated by multiplying the weights assigned to each of five possible data providers by the status of the data—was it positive or negative. This sum is multiplied by the weight assigned this data collection source in the total algorithm. The total weighted calculation (TWC) represents the sum of all of the defined data collection sources and weights.

The equation represents the quantification of qualitative data. It is not, however, void of intuitive or subjective judgments as supervisors must make qualitative evaluations of the data as it is collected and in its interpretation during coding into the algorithm.

As has been discussed, data provided by the jury of performance evaluation experts were used to develop the assessment algorithm. The
algorithm was used to create a tool which could be used by performance evaluation experts to process assessment data. This tool, the Knowledge-Based Assessment System (K-BAS), develops a performance score which can be used to define a status recommendation for the teacher being evaluated.

Feasibility testing

Developing the computer-based decision system for teacher performance evaluation was the major thrust of this dissertation. A small feasibility check was completed, however, to see if K-BAS was workable. The feasibility test consisted of two parts, (a) performance evaluator's ratings of five scenarios and (b) a comparison of these ratings with K-BAS results.

Performance evaluators

To test the feasibility of using an assessment algorithm in a knowledge-based system, it was necessary to duplicate the performance evaluation process. Hypothetical performance scenarios have been used successfully in training sessions to teach evaluation skills. For this reason, performance scenarios were selected to test K-BAS.

Performance scenarios contain archival information related to the instructional effectiveness of a particular teacher. This information can be in many forms. The six data collection sources selected for inclusion in K-BAS represent the type of data reviewed during the evaluation process. These six data collection sources: (1) teacher
performance evaluation criteria; (2) anecdotal notations; (3) achievement data; (4) special conditions data; (5) interventions ratings; and (6) performance record data, were all used in the performance scenarios developed to test K-BAS.

After reviewing sample performance scenarios, five were created (Appendix M). The development of five scenarios allowed for the portrayal of differing levels of instructional effectiveness. This diversity was needed to assure the integrity of the algorithm, i.e., was it able to detect widely disparate aptitudes as well as discriminate between more closely matched performances.

Scenario one portrays a teacher whose performance is below standard. All data are extremely low or negative. This scenario was created to establish a base for the score spread. Scenario two, in contrast, describes an exemplary employee whose performance is obviously above average. Data in scenario three portray a teacher whose performance is definitely status quo, i.e., average ratings in all categories and classifications. Scenario four presents a teacher whose instructional performance is mediocre; performance record shows a steady decline in ability and personal life has been very stressful during the last year. The last scenario depicts a teacher whose instructional performance is average: performance record shows steady improvement, student achievement scores are low, and life has been rather stressful during the last year.

In these hypothetical performance scenarios, respondents were
asked to: (1) review data from each of the six sources; (2) comment on the manner in which they would be used; (3) indicate additional data to which access is desired; and (4) develop a status recommendation for that employee based on their interpretation of the data.

The performance scenarios were mailed to twelve experienced evaluators from Iowa. To assure that respondents had some skills in teacher performance evaluation, a state requiring training in teacher performance evaluation was used. The seven evaluators selected to complete scenarios were colleagues or associates of the researcher. All of these individuals had a deep interest in the evaluation process. This is evidenced through their affiliation with the School Improvement Model projects at Iowa State University whose central mission is that of improved performance evaluation.

Ten evaluators were asked to respond to the scenarios. This established a balance between the number of performance evaluation experts contributing to the algorithm and the number of evaluators responding to the performance scenarios. Each subject received a letter of instructions (Appendix N) and the five scenarios. No controls were placed on this population as the intent of this research was to establish the feasibility of a product—not to complete an in-depth analysis of discrepancies across attribute groups.

**K-BAS Analysis**

To provide for a comparative analysis and thereby check the feasibility of the assessment algorithm, K-BAS was used to analyze
each of the five performance scenarios and provide a performance score. The analysis completed by K-BAS replicated assessments made by performance evaluators. The resultant comparison pits performance evaluators against the jury of performance evaluation experts as reflected in the algorithm.

**Final analysis**

These data obtained from the performance evaluators were compiled and analyzed. Respondents provided a performance score and a status recommendation for each of the five performance scenarios. These performance scores were compared to performance scores obtained from the algorithm and developed by K-BAS. Feasibility was determined by point spread without the use of inferential statistics. It was assumed that the algorithm will provide more reliable performance scores than those obtained from the evaluators, therefore, scores evidencing substantial deviation were considered important. The presence of such scores indicates the need for quantification and definition of components in the performance evaluation process—the function accomplished by the assessment algorithm.

The Iowa State University Committee on the Use of Human Subjects in Research reviewed this project and concluded that the rights and welfare of the human subjects were adequately protected, that risks were outweighed by the potential benefits and expected value of the knowledge sought, that confidentiality of data was assured and that informed consent was obtained by appropriate procedures.
CHAPTER IV. RESULTS

In Chapter III, reference was made to a questionnaire and five performance scenarios which were developed as part of this research. The discussion in this chapter will provide an analysis and interpretation of the data retrieved from these instruments. Section one reviews design of the Knowledge-Based Assessment System (K-BAS) created as a result of this research. Section two contains an examination of data recovered from teacher performance evaluation experts and the methodology used to incorporate them into the knowledge base of K-BAS. Section three presents a comparative analysis of supervisor and systems data.

Product Development Knowledge Based Assessment System

The design aspects of a knowledge-based system are not radically different from those in any research project. The parlance of the field may present a barrier at times, but basically, development follows a sequential pattern not unlike that used with any product. The primary stages of development consist of the following.

Determination of appropriate consultation paradigm

An assessment of expected outcomes, and of the structure of the knowledge to be incorporated into the knowledge base, allowed for determination of a consultation paradigm. It was decided that a diagnostic/prescriptive paradigm would best fit the needs of this research. This decision a result of the fact that performance
evaluation data would be "diagnosed" and a status recommendation would be "prescribed." Other consultation paradigms exist to assist in the planning and design of projects and problems. The diagnosis/prescription paradigm is by far the most popular.

**Selection of a structure**

A variety of options exist for knowledge base authors in the development of expert systems. These options include: small system building tools; large, narrow system building tools and large, hybrid system building tools. A careful assessment of expected goals and outcomes prior to the selection of a specific tool is mandatory. Factors considered during the evolution of K-BAS included: programming language, the number of rules contained in its knowledge base, hardware requirements, cost, availability of tools, consultation paradigm match, and the knowledge base author's programming skills.

BASIC, a universally accepted programming language, was selected for K-BAS. BASIC allows for linear conventional programming and provided the structure needed for the knowledge base in K-BAS.

An expert system shell written in C was originally selected for product development. As programming progressed, it became evident that this shell would prove unfeasible due to restrictions on the number of rules it could contain. The shell was designed to allow for the initial design and demonstration of small expert systems, thus it was structured to accept only twenty rules. The complexity of the teacher performance
evaluation process demands the use of considerably more than twenty rules.

The cost involved in procurement of a shell which would house all of the rules contained within the K-BAS knowledge base proved to be prohibitive. Shells of this type cost anywhere from $3,000 to $60,000. Thus, BASIC was chosen as a logical alternative.

**Programming**

Basic programming structure and techniques as discussed in Chapter II were used in the development of K-BAS. Analysis of the problem, design of the algorithm, coding of the program, and verification of program function constitute the principal activities. Code written for each of the six data collection sources was placed within subroutines accessed through the menu. The menu was written to allow the user access: to any of the six data collection sources, to a status recommendation, or to program termination.

Completion of these three processes (determination of appropriate consultation paradigm, selection of a structure and programming) yields a product ready for review and revision. Many repeated executions of the program, each involving close scrutiny of program logic, user interface (clarity of text, simplicity of commands), and program format, test product effectiveness. At the conclusion of this "test and try" period, screen displays and interactive commands should be complete.
K-BAS Screen Displays

After invoking K-BAS, the user is presented with introductory text explaining the program's purpose and outlining the process involved in analysis of performance data.

SCREEN ONE

***********************WELCOME TO K-BAS***********************

KNOWLEDGE-BASED ASSESSMENT SYSTEM

(FOR USE WITH TEACHER PERFORMANCE EVALUATION DATA)

This knowledge-based system has been developed to assist you in completing the performance evaluation process. You will be asked to enter six types of data, all previously collected during the assessment cycle. These data will be analyzed within an algorithm and a status recommendation of: (1) promotion; (2) maintenance; (3) probation; or (4) termination will be developed. The algorithm has been structured to capture the expertise of performance evaluation specialists and use this information as it processes data you have entered.

Please reference the paperware accompanying this program for additional information on program rationale and data entry procedures.

PRESS 'ENTER' WHEN YOU ARE READY TO CONTINUE:

The user is directed to reference the paperware which accompanies K-BAS. This resource (Appendix 0) was written to assist the user in understanding the mechanics of program function, program construction and the research base underlying program design. These documentation
materials are to be used in conjunction with the software program. Screen Two provides the user with additional instructions for program use.

SCREEN TWO

K-BAS REQUESTS YOUR RESPONSE TO A SERIES OF QUESTIONS. PLEASE READ INSTRUCTIONS CAREFULLY AND ENTER DATA ACCURATELY. THE PROGRAM PROVIDES OPPORTUNITIES WITHIN EACH DATA ENTRY SECTION FOR REENTRY OF INCORRECTLY SUBMITTED INFORMATION.

K-BAS IS MENU-DRIVEN, OFFERING EIGHT OPTIONS FOR YOUR CONSIDERATION. TO BEGIN THE ANALYSIS, YOU WILL NEED TO PRESS THE 'ENTER' KEY, SELECT THE DATA COLLECTION SOURCE YOU DESIRE, AND ENTER THE APPROPRIATE CODE FOR THAT OPTION.

PRESS 'ENTER' WHEN YOU ARE READY TO BEGIN:

As indicated in Screen Two, K-BAS allows the user easy access to each of the data collection sources through a central menu. At the completion of each data entry section, the user is returned to the menu for the next selection. The menu also includes a data entry check; this affords the user the opportunity to verify completion of a specific data entry section.

Data held in the data entry sections are not protected. The user can exercise the option of reentry at any point in the program. Data are held only until new data overwrites them. This structure allows the user maximum flexibility in data entry and correction.
Screen Three presents the options contained on the central program menu.

SCREEN THREE

OPTION MENU FOR ALGORITHM DATA SOURCE
SELECT THE OPTION YOU NEED AND ENTER THE ACCESS CODE

<table>
<thead>
<tr>
<th>CODE</th>
<th>OPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PERFORMANCE CRITERIA</td>
</tr>
<tr>
<td>2</td>
<td>ANECDOTAL NOTATIONS</td>
</tr>
<tr>
<td>3</td>
<td>INTERVENTION RATINGS</td>
</tr>
<tr>
<td>4</td>
<td>ACHIEVEMENT DATA</td>
</tr>
<tr>
<td>5</td>
<td>SPECIAL CONDITIONS DATA</td>
</tr>
<tr>
<td>6</td>
<td>PERFORMANCE RECORD DATA</td>
</tr>
<tr>
<td>7</td>
<td>TOTAL ALGORITHM REPRESENTATION</td>
</tr>
<tr>
<td>8</td>
<td>PROGRAM TERMINATION</td>
</tr>
</tbody>
</table>

YOU HAVE COMPLETED THE FOLLOWING DATA SECTIONS:
   PERF.EVAL.    ANC.NOT
   INTR.DATA     ACH.DATA
   SPEC.COND.    PERF.REC.

ENTER THE DESIRED OPTION (1 TO 8):

Upon entry into any of the six data collection sources, the user is presented with introductory text explaining key components in that section. Instructions related to data entry procedures are also provided. Upon selection of option one, Teacher Performance Criteria, the user will receive the message on Screen Four:
**SCREEN FOUR**

**DATA COLLECTION SOURCE ONE**

**TEACHER PERFORMANCE EVALUATION CRITERIA**

K-BAS uses data collected from the Teacher Performance Evaluation Instrument developed at Iowa State University. Prior to data entry for this section, you should have the following materials: (1) A completed summative evaluation.

For each of the twenty criteria, enter the appropriate rating (one to five) and press 'enter'.

Press 'return' when you are ready for data entry:

Proceeding to the data entry section of the program allows the user to input requested data. Screen five displays this section.

**SCREEN FIVE**

**TEACHER PERFORMANCE CRITERIA DATA ENTRY SECTION**

Enter a rating between one and five:

**CRITERION 1:** Demonstrates effective planning skills;
**CRITERION 2:** Implements the lesson plan;
**CRITERION 3:** Motivates students;
**CRITERION 4:** Communicates effectively with students;
**CRITERION 5:** Provides students with evaluative feedback;
**CRITERION 6:** Prepares appropriate evaluation activities;
**CRITERION 7:** Displays knowledge of curriculum & subject matter;
**CRITERION 8:** Learning content congruent with curriculum;
**CRITERION 9:** Opportunities for individual differences;
**CRITERION 10:** Ensures student time on task;
**CRITERION 11:** Sets high expectations for student achievement;
**CRITERION 12:** Effective use of time, materials, resources;
**CRITERION 13:** Demonstrates evidence of personal organization;
**CRITERION 14:** Sets high standards for student behavior;
**CRITERION 15:** Organizes students for effective instruction;
**CRITERION 16:** Effective interpersonal relationships;
**CRITERION 17:** Demonstrates awareness of needs of students;
**CRITERION 18:** Promotes positive self-concept;
**CRITERION 19:** Sensitivity in relating to students;
**CRITERION 20:** Promotes self-discipline and responsibility;
At this point in the program, a verification loop is available allowing the user to proceed to the next screen, or return and correct inaccurate data entries. Screen Six illustrates this concept.

SCREEN SIX

YOU HAVE ENTERED THE FOLLOWING DATA:

CRITERION 1: CRITERION 11:
CRITERION 2: CRITERION 12:
CRITERION 3: CRITERION 13:
CRITERION 4: CRITERION 14:
CRITERION 5: CRITERION 15:
CRITERION 6: CRITERION 16:
CRITERION 7: CRITERION 17:
CRITERION 8: CRITERION 18:
CRITERION 9: CRITERION 19:
CRITERION 10: CRITERION 20:

ENTER '1' IF YOU NEED TO REENTER DATA
PRESS 'RETURN' IF YOU WISH TO PROCEED
INDICATE YOUR CHOICE HERE:

The user is then presented with the aggregate sum for data entered and redirected to the menu. Screen Seven displays aggregate sum data.

SCREEN SEVEN

THE INDIVIDUAL AGGREGATE SUM FOR THESE DATA EQUALS:
THIS SUM WILL BE WEIGHTED AND PLACED IN THE ASSESSMENT ALGORITHM.

WHEN YOU ARE READY TO CONTINUE, PRESS 'ENTER':
The user would logically progress to the second option on the menu. The textual introduction for option two, Anecdotal Notations, appears in Screen Eight.

SCREEN EIGHT

********************DATA COLLECTION SOURCE TWO******************************
********************ANECDOtal NOTATIONS*******************************

ANECDOTAL NOTATIONS ARE DERIVED FROM MANY SOURCES. K-BAS HAS ASSIGNED A WEIGHT TO EACH POTENTIAL DATA SOURCE. WHEN YOU ENTER YOUR DATA IT WILL BE NECESSARY FOR YOU TO INDICATE TO THE SYSTEM THE APPROPRIATE WEIGHT OF THE DATA YOU ARE ENTERING. OBVIOUSLY, THE STATUS OF YOUR DATA MUST ALSO BE CONSIDERED IN THE DECISION-MAKING PROCESS. YOU WILL NEED TO INDICATE TO THE SYSTEM THE APPROPRIATE STATUS FOR YOUR DATA.

PRIOR TO DATA ENTRY FOR THIS SECTION, YOU SHOULD HAVE THE FOLLOWING MATERIALS: (1) FIVE SOURCES OF DATA; (2) THE APPROPRIATE WEIGHT AND STATUS FOR ALL ENTRIES.

PRESS 'ENTER' WHEN YOU ARE READY TO BEGIN:

The user is then presented with information needed for data entry. Screen Nine displays this information.

SCREEN NINE

************************DATA ENTRY SECTION ANECDOTAL NOTATIONS***********************

THESE WEIGHTINGS HAVE BEEN DETERMINED FOR THE FOLLOWING DATA PROVIDERS:

<table>
<thead>
<tr>
<th>Provider</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADMINISTRATOR</td>
<td>ENTER 2.75</td>
</tr>
<tr>
<td>PARENT</td>
<td>ENTER 2.38</td>
</tr>
<tr>
<td>STUDENT</td>
<td>ENTER 3.75</td>
</tr>
<tr>
<td>TEACHER</td>
<td>ENTER 2.71</td>
</tr>
<tr>
<td>OTHER</td>
<td>ENTER 3.60</td>
</tr>
</tbody>
</table>

ENTER THE APPROPRIATE WEIGHT FOR YOUR DATA:
The status of the user's data is requested in Screen Ten.

SCREEN TEN

These weightings have been determined as indicative of data status:

Positive data: Enter 2
Negative data: Enter 1

Enter the appropriate status for your data:

The user is prompted to enter five pieces of data in the same manner. After all data for this source have been entered, the system uses a verification loop to allow for reentry of data. Screen Eleven illustrates this design feature.

SCREEN ELEVEN

You have entered the following data:

<table>
<thead>
<tr>
<th>Data</th>
<th>Weight</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source One</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source Two</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source Three</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source Four</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source Five</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Enter 1 if you need to reenter data. Press 'Enter' if you wish to proceed. Indicate your choice here:
If the user decides to reenter data, the program loops back to the start of the entry sequence. After all data have been satisfactorily entered, the user is presented with the aggregate score for this data collection source and redirected to the menu. Screen Twelve presents aggregate sum data.

SCREEN TWELVE

THE AGGREGATE SUM FOR THESE DATA EQUALS:  
THIS SUM WILL BE WEIGHTED AND PLACED IN  
THE ASSESSMENT ALGORITHM.

WHEN YOU ARE READY TO CONTINUE, PRESS 'ENTER':

The third data collection source on the menu, Intervention Ratings, would be the next logical choice for the user. The initial display for this section is presented in Screen Thirteen:

SCREEN THIRTEEN

***************DATA COLLECTION SOURCE THREE***************  
**************INTERVENTION RATINGS**************

K-BAS USES PRESCRIPTIVE INTERVENTION DATA IN THE  
FORMATION OF ITS STATUS ALGORITHM. YOU WILL NEED TO ENTER  
THREE PIECES OF DATA AND INDICATE THE STATUS OF EACH—WERE  
ANTICIPATED OUTCOMES REALIZED AS A RESULT OF THE INTERVENTION?

PRIOR TO DATA ENTRY FOR THIS SECTION, YOU SHOULD HAVE  
THE FOLLOWING MATERIALS: (1) THREE PIECES OF DATA; (2) A  
STATUS ASSIGNMENT OF POSITIVE OR NEGATIVE FOR EACH PIECE OF DATA.  
PRESS 'ENTER' WHEN YOU ARE READY TO BEGIN:
At the onset of each data collection section, the user is provided with a list of materials needed for data entry. This section requires the user to enter three pieces of data (as indicated by performance experts) and indicate a status of positive or negative for each. A positive status assignment indicating that expected outcomes were realized; a negative status assignment indicating that desired outcomes did not occur. The user next proceeds to the data entry section. Screen Fourteen displays this section.

SCREEN FOURTEEN

************************************************************************DATA ENTRY SECTION************************************************************************

AS INDICATED ABOVE, YOU WILL NEED TO ENTER THREE SOURCES OF DATA TO ALLOW THE ALGORITHM TO FUNCTION. YOU WILL ALSO NEED TO ENTER THE STATUS OF EACH INTERVENTION—WAS IT POSITIVE OR NEGATIVE?

THESE WEIGHTS HAVE BEEN DETERMINED AS INDICATIVE OF DATA STATUS:

POSITIVE DATA: ENTER 2
NEGATIVE DATA: ENTER 1

ENTER THE APPROPRIATE STATUS FOR DATA SOURCE ONE:

K-BAS allows the user to enter all three sources of data and then provides a verification loop. This structure can be seen in Screen Fifteen.
YOU HAVE ENTERED THE FOLLOWING DATA:

<table>
<thead>
<tr>
<th>DATA</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOURCE ONE</td>
<td>2</td>
</tr>
<tr>
<td>SOURCE TWO</td>
<td>2</td>
</tr>
<tr>
<td>SOURCE THREE</td>
<td>2</td>
</tr>
</tbody>
</table>

ENTER 1 IF YOU NEED TO REENTER DATA.
PRESS 'ENTER' IF YOU WISH TO PROCEED.
INDICATE YOUR CHOICE HERE:

After all data have been entered, the user is presented with the aggregate sum for this data collection source redirected to the menu. Screen Sixteen presents aggregate sum data.

SCREEN SIXTEEN

THE AGGREGATE SUM FOR THESE DATA EQUALS:
THIS SUM WILL BE WEIGHTED AND PLACED IN THE ASSESSMENT ALGORITHM.

WHEN YOU ARE READY TO CONTINUE, PRESS 'ENTER':

The fourth option on the Data Source Menu is Achievement Data. The user would be presented with the introductory comments displayed on Screen Seventeen.
SCREEN SEVENTEEN

********************************DATA COLLECTION SOURCE FOUR******************
***************ACHIEVEMENT DATA***************

K-BAS HAS BEEN WRITTEN TO ACCEPT STANDARDIZED NORM-REFERENCED ACHIEVEMENT DATA AND CRITERION-REFERENCED TEST DATA. WHEN NORM-REFERENCED TEST DATA IS USED, THE FOLLOWING CRITERIA APPLY: (1) THE CUMULATIVE SCORE WHICH BEST REPRESENTS THE TEACHER'S IMPACT UPON STUDENT ACHIEVEMENT SHOULD BE USED, AND (2) NATIONAL NORMS SHOULD BE REFERENCED.

WHEN CRITERION-REFERENCED TEST DATA IS USED, THE FOLLOWING GUIDELINE APPLIES: (1) CUMULATIVE STUDENT SCORES REPRESENTING OVERALL STUDENT PERFORMANCE SHOULD BE USED.

IN EITHER CASE, YOU SHOULD SELECT FROM THE RANKINGS LIST THE APPROPRIATE CATEGORY FOR YOUR DATA AND ENTER THAT RANK AT THE PROMPT.

PRESS 'ENTER' WHEN YOU ARE READY TO BEGIN:

The user would then proceed to the data entry section to review the rankings and select the appropriate rank for the data to be entered. Screen Eighteen depicts these ranks.

SCREEN EIGHTEEN

********************************DATA ENTRY SECTION ACHIEVEMENT DATA***************************

THESE RANKS HAVE BEEN DETERMINED FOR THE FOLLOWING STUDENT ACHIEVEMENT DATA:

63% OF STUDENTS SCORE ABOVE THE 85TH PERCENTILE: ENTER 5
50% OF STUDENTS SCORE ABOVE THE 85TH PERCENTILE: ENTER 4
38% OF STUDENTS SCORE ABOVE THE 85TH PERCENTILE: ENTER 3
26% OF STUDENTS SCORE ABOVE THE 85TH PERCENTILE: ENTER 2
17% OF STUDENTS SCORE ABOVE THE 85TH PERCENTILE: ENTER 1

ENTER THE APPROPRIATE RANK FOR YOUR DATA:
A verification loop is available for the convenience of data reentry. Screen Nineteen presents this structure.

SCREEN NINETEEN

YOU HAVE ENTERED THE FOLLOWING RANK:

ENTER '1' IF YOU WISH TO REENTER YOUR DATA.
PRESS 'RETURN' IF YOU WISH TO PROCEED.
INDICATE YOUR CHOICE HERE:

After inputing the appropriate rank for the data used, the user is presented with the numerical rank and redirected to the menu. Screen Twenty displays this datum.

SCREEN TWENTY

THE NUMERICAL RANK FOR THESE DATA EQUALS:

THIS RANK WILL BE WEIGHTED AND PLACED IN THE ASSESSMENT ALGORITHM.

WHEN YOU ARE READY TO CONTINUE, PRESS 'RETURN':
Special Conditions Data is the fifth option on the menu. The user would be presented with introductory comments found on Screen Twenty-one.

SCREEN TWENTY-ONE

***************DATA COLLECTION SOURCE FIVE**********************

***************SPECIAL CONDITIONS DATA***************

K-BAS HAS BEEN DESIGNED TO ACCEPT DATA OF A SPECIAL NATURE WHICH MIGHT HAVE AN EFFECT UPON THE EMPLOYEE ASSESSMENT. THE INCLUSION OF THESE DATA SERVES TO SUBSIDIZE THE ALGORITHM SO THAT THE EMPLOYEE CONCERNED RECEIVES ADDITIONAL POINTS TOWARDS FORMATION OF THE STATUS RECOMMENDATION. AS WITH OTHER K-BAS DATA, A WEIGHTING HAS BEEN ASSIGNED TO EACH AVAILABLE OPTION. YOU WILL NEED TO SELECT THAT OPTION REPRESENTING THE CONDITION YOU WISH TO INCLUDE AND ENTER THE APPROPRIATE CODE.

PRIOR TO DATA ENTRY FOR THIS SECTION, YOU SHOULD HAVE THE FOLLOWING MATERIALS: (1) ANY DATA YOU WISH TO ENTER.

IF YOU DO NOT HAVE DATA YOU WISH TO ENTER, PLEASE EXIT THIS SECTION BY ENTERING "1". PRESS "ENTER" IF YOU WISH TO PROCEED.

INDICATE YOUR CHOICE HERE:

The user has an option in this section not provided in others—to exit or continue. The nature of the data in this section mandates this option; the employee being evaluated may not have been affected by any of these conditions. A default in this section has a neutral impact upon data. If the user continues into the data entry section, comments displayed on Screen Twenty-two appear.
**********DATA ENTRY SECTION SPECIAL CONDITIONS DATA **********

PLEASE INDICATE IF ANY OF THE FOLLOWING CONDITIONS WERE PRESENT DURING THE ASSESSMENT PERIOD. ENTER THE APPROPRIATE NUMERICAL DESIGNATION TO INCLUDE THESE DATA. THE SYSTEM ALLOWS FOR THE ENTRY OF TWO SOURCES OF DATA. IF YOU HAVE ONLY ONE PIECE OF DATA, YOU SHOULD ENTER A "ZERO" AT THE PROMPT FOR THE SECOND DATA.

- DEATH OF FAMILY MEMBER: ENTER 3.13
- BIRTH IN THE FAMILY: ENTER 1.75
- PHYSICAL IMPAIRMENT OF FAMILY MEMBER: ENTER 2.50
- PHYSICAL IMPAIRMENT OF EMPLOYEE: ENTER 4.13
- EMOTIONAL DISABILITY IN FAMILY: ENTER 3.50
- EMOTIONAL DISABILITY OF EMPLOYEE: ENTER 4.20
- MARRIAGE OR DIVORCE: ENTER 2.50
- RECIPIENT OF A MAJOR AWARD: ENTER 3.00
- MAJOR ACCOMPLISHMENT: ENTER 3.00

ENTER THE NUMBER WHICH REPRESENTS DATA SOURCE ONE:

The user is given the option of entering a second piece of data and then directed to the verification loop to check entered data.

Screen Twenty-three displays the verification structure.
After the user is satisfied with the data entry, K-BAS presents the aggregate sum for this data collection source and redirects the user to the menu. Screen Twenty-four depicts the aggregate sum data.

SCREEN TWENTY-FOUR

THE AGGREGATE SUM FOR THESE DATA EQUALS:

THIS SUM WILL BE WEIGHTED AND PLACED IN THE ASSESSMENT ALGORITHM.

WHEN YOU ARE READY TO CONTINUE, PRESS 'ENTER':

Option six, Performance Record Data, is the final data collection source. The introductory text for this section is presented on Screen Twenty-five.

SCREEN TWENTY-FIVE

****************DATA COLLECTION SOURCE SIX****************

********PERFORMANCE RECORD DATA**********

K-BAS USES DATA COLLECTED FROM PREVIOUS PERFORMANCE EVALUATIONS. THESE DATA ARE PLACED IN THE STATUS ALGORITHM. YOU WILL BE ASKED TO ENTER A RANK REPRESENTING THE AGE OF THE DATA YOU ARE USING AND TO INDICATE THE STATUS OF YOUR DATA—WAS IT POSITIVE OR NEGATIVE. YOU WILL NEED TO ENTER THREE SOURCES OF DATA TO ALLOW THE ALGORITHM TO FUNCTION.

WHEN YOU ARE READY TO CONTINUE, PRESS "ENTER":

-
After reading these comments, the user will be directed to the data entry section. Screen Twenty-six presents this section.

SCREEN TWENTY-SIX

*****DATA ENTRY SECTION: PERFORMANCE RECORD DATA******

INDICATE THE APPROPRIATE RANK FOR EACH OF THE DATA YOU WILL BE ENTERING. YOU WILL NEED TO ENTER THREE SOURCES OF DATA TO ALLOW THE ALGORITHM TO FUNCTION. PLEASE USE THE FOLLOWING RANKING SYSTEM.

<table>
<thead>
<tr>
<th>DATA</th>
<th>ENTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIVE YEARS OF AGE</td>
<td>1</td>
</tr>
<tr>
<td>FOUR YEARS OF AGE</td>
<td>2</td>
</tr>
<tr>
<td>THREE YEARS OF AGE</td>
<td>3</td>
</tr>
<tr>
<td>TWO YEARS OF AGE</td>
<td>4</td>
</tr>
<tr>
<td>ONE YEAR OLD</td>
<td>5</td>
</tr>
</tbody>
</table>

ENTER THE APPROPRIATE RANK FOR YOUR DATA:

The status of the data is requested in Screen Twenty-seven.

SCREEN TWENTY-SEVEN

YOU WILL ALSO NEED TO ENTER THE STATUS OF YOUR DATA. THESE WEIGHTS HAVE BEEN DETERMINED AS INDICATIVE OF DATA STATUS:

<table>
<thead>
<tr>
<th>DATA STATUS</th>
<th>ENTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSITIVE DATA</td>
<td>2</td>
</tr>
<tr>
<td>NEGATIVE DATA</td>
<td>1</td>
</tr>
</tbody>
</table>

ENTER THE APPROPRIATE STATUS FOR YOUR DATA:
In Screen Twenty-eight, K-BAS offers the user a verification check.

### SCREEN TWENTY-EIGHT

**YOU HAVE ENTERED THE FOLLOWING DATA:**

<table>
<thead>
<tr>
<th>DATA</th>
<th>RANK</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOURCE ONE</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>SOURCE TWO</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>SOURCE THREE</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

ENTER "1" IF YOU NEED TO REENTER DATA.
PRESS "ENTER" IF YOU WISH TO PROCEED.
INDICATE YOUR CHOICE HERE:

After the data have been accurately entered, the user is directed to Screen Twenty-nine which presents the aggregate sum and redirects the user to the menu.

### SCREEN TWENTY-NINE

THE AGGREGATE SUM FOR THESE DATA EQUALS:

THIS SUM WILL BE WEIGHTED AND PLACED IN THE ASSESSMENT ALGORITHM.

WHEN YOU ARE READY TO CONTINUE, PRESS "ENTER":
After data has been successfully entered for each of the six data collection sources, the user will proceed to menu option seven, Total Algorithm Representation. The introductory screen presents comments displayed in Screen Thirty.

SCREEN THIRTY

***************TOTAL ALGORITHM REPRESENTATION***************

THE DATA YOU HAVE ENTERED HAS BEEN ANALYZED AS DESCRIBED IN THE INTRODUCTION TO THIS PROGRAM AND AS SPECIFICALLY DELINEATED IN THE RESOURCE MATERIALS ACCOMPANYING THIS SOFTWARE. IT MUST BE EMPHASIZED THAT THE RESULTANT STATUS ASSIGNMENT SHOULD BE CONSIDERED AS ANOTHER TOOL TO BE USED IN THE EVALUATION PROCESS. IT MUST BE PLACED IN THE APPROPRIATE CONTEXT AND PAIRED WITH OTHER ASSESSMENT PROCEDURES.

WHEN YOU ARE READY TO CONTINUE, PRESS "ENTER":

The user is provided with the data which will be used in the determination of the status recommendation. This allows the user to make a final check for accuracy before the data are accepted by K-BAS as legitimate. Screen Thirty-one displays this check.
THE FOLLOWING DATA HAVE BEEN USED TO DEVELOP THE STATUS RECOMMENDATION.

<table>
<thead>
<tr>
<th>DATA</th>
<th>AGG.SUM</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRITERIA</td>
<td>245.6</td>
<td>3.33</td>
</tr>
<tr>
<td>ANCDTL. NOTAT.</td>
<td>25.3</td>
<td>2.50</td>
</tr>
<tr>
<td>INTERVENTION</td>
<td>5</td>
<td>2.83</td>
</tr>
<tr>
<td>ACHIEVEMENT</td>
<td>3</td>
<td>4.00</td>
</tr>
<tr>
<td>SPEC. CONDIT.</td>
<td>3.46</td>
<td>1.67</td>
</tr>
<tr>
<td>PERFORMANCE REC.</td>
<td>15</td>
<td>3.17</td>
</tr>
</tbody>
</table>

THESE DATA YIELD A TOTAL ALGORITHM SCORE OF:

PRESS "ENTER" WHEN YOU ARE READY TO PROCEED TO THE NEXT SCREEN:

The user is now ready to receive the effectiveness classification. Screen Thirty-two displays this recommendation.

SCREEN THIRTY-TWO

THIS SCORE RESULTS IN A STATUS RECOMMENDATION FOR YOUR DATA OF MAINTENANCE.

PRESS "ENTER" TO RETURN TO THE MENU:
At this point, the user has the option of using the system to complete another evaluation, or of terminating the program. Program termination results in the system thanking the user and closing the file.

Another feature of the program, operational at any point where the user is asked to enter data, is a validity check. This function serves to monitor data entered by the user to assure that it fits into specified parameters. When inappropriate data are detected by the system, a user prompt is presented. This structure is illustrated in Screen Thirty-three.

SCREEN THIRTY-THREE

ENTER THE STATUS FOR DATA THREE: 4

(STATUS WEIGHT MUST BE GREATER THAN 0, LESS THAN 3)

ENTER THE STATUS FOR DATA THREE:

As briefly mentioned in earlier text, paperware has been designed to accompany K-BAS (Appendix 0). The paperware provides: instructions for system use, documentation of product design, and an overview of the research base from which the product originated. Its design reflects concepts and processes discussed previously. The user should read this
Data Obtained From Teacher Performance Evaluation Experts

In Chapter III, the questionnaire (Knowledge Base Design Tool) was designed to gather information relevant to the teacher performance evaluation process was discussed. Data retrieved in the questionnaire from the ten performance evaluation experts were used in the formation of the knowledge-base for K-BAS. The experts were requested to provide identification of: (1) reliable data collection sources; (2) appropriate weights for classifications and categories in the selected data collection sources; and (3) appropriate weights for data collection sources as they function in the total algorithm.

The performance evaluation experts were presented with six possible data collection sources and their respective categories. As identified in the literature, these six sources were: (1) teacher performance evaluation criteria, (2) anecdotal notations, (3) special conditions data, (4) performance record data, (5) achievement data, and (6) interventions ratings. Categories particular to each data collection source can be reviewed in the Knowledge Base Design Tool (Appendix J).

To ascertain if this list of data collection sources was complete and reliable, the jury of experts was asked to validate it and suggest additional sources which might have been overlooked. To evaluate sources for inclusion, the following criterion was established; the data source must be suggested by more than half of the respondents. An
analysis of the data indicated eleven data sources were proposed by the experts with no one source receiving more than a single nomination. Proposed sources included the following: (1) student success criteria; (2) years of experience; (3) characteristics of students, i.e., socio-economic status, intelligence, family stability; (4) curricular relevance, e.g., kindergarten teacher required to teach writing is in trouble, high school teacher required to teach old fashioned civics is in trouble, algebra teachers can't win; (5) non-technical assignments and/or non-teaching contributions; (6) previous accomplishments; (7) novice or master status of teacher; (8) artifacts; (9) work samples; (10) general climate of school; and (11) stability of classroom membership. Since none of these data sources met the criterion for inclusion, the original six data collection sources were used in formation of the algorithm.

Data collection source one: Teacher performance evaluation criteria

Defined as indices of instructional effectiveness, extensive research at Iowa State University has validated the criteria selected for inclusion in the assessment algorithm. The experts were asked to weigh each of the twenty criteria as to its ability to act as a discriminating index of teacher performance. A rating scale of one to five was chosen for use throughout the instrument; thus a result of the number of category items requiring this numeric span.

Criterion weights provided by the ten performance evaluation
experts were collected and averaged. Table 1 presents the results of these computations. Averages were rounded to hundredths; those holding fives in the thousandth place were rounded to the next higher integer. Those items given no response were withheld from calculation.

The data depict a difference of 1.52 points between that criterion receiving the most weight (4.38) and that scored the lowest (2.86). Average weights in each of the three performance areas were:

1. Productive Teaching Techniques (criteria 1 - 11) = 3.81;
2. Organized, Structured Classroom Management (criteria 12 - 15) = 3.63;
3. Positive Interpersonal Relationships (criteria 16 - 20) = 3.08. These data suggest that performance area one contains the criteria with the most impact on instructional effectiveness.

Listed in descending order of importance, these criteria were identified as being the most important: communicates effectively with students, demonstrates effective planning skills, ensures student time on task, sets high expectations for student achievement, provides evaluative feedback, and motivates students. All of these are in the performance area of productive teaching techniques. Criteria considered by the experts to be of lesser importance include: evidence of personal organization, promotes positive self-concept, promotes self-discipline and responsibility, demonstrates sensitivity in relating to students, knowledge of curriculum and subject matter, and provides opportunities for individual differences. As would not
Table 1. Data Collection Source: Performance Evaluation Criteria Weights as Defined by Evaluation Experts

<table>
<thead>
<tr>
<th>CRITERION</th>
<th>ASSIGNED WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrates effective planning skills</td>
<td>4.25</td>
</tr>
<tr>
<td>Implements the lesson plan</td>
<td>3.63</td>
</tr>
<tr>
<td>Motivates students</td>
<td>4.00</td>
</tr>
<tr>
<td>Communicates effectively with students</td>
<td>4.38</td>
</tr>
<tr>
<td>Provides evaluative feedback</td>
<td>4.13</td>
</tr>
<tr>
<td>Prepares appropriate evaluation activities</td>
<td>3.75</td>
</tr>
<tr>
<td>Knowledge of curriculum and subject matter</td>
<td>3.13</td>
</tr>
<tr>
<td>Learning content congruent with curriculum</td>
<td>3.19</td>
</tr>
<tr>
<td>Provides opportunities for individual differences</td>
<td>3.13</td>
</tr>
<tr>
<td>Ensures student time on task</td>
<td>4.16</td>
</tr>
<tr>
<td>Sets high expectations for student achievement</td>
<td>4.13</td>
</tr>
<tr>
<td>Effective use of time, materials, and resources</td>
<td>3.88</td>
</tr>
<tr>
<td>Evidence of personal organization</td>
<td>2.86</td>
</tr>
<tr>
<td>Sets high standards for student behavior</td>
<td>3.88</td>
</tr>
<tr>
<td>Organizes students for effective instruction</td>
<td>3.88</td>
</tr>
<tr>
<td>Effective interpersonal relationships with others</td>
<td>3.00</td>
</tr>
<tr>
<td>Demonstrates awareness of the needs of students</td>
<td>3.25</td>
</tr>
<tr>
<td>Promotes positive self-concept</td>
<td>3.00</td>
</tr>
<tr>
<td>Demonstrates sensitivity in relating to students</td>
<td>3.13</td>
</tr>
<tr>
<td>Promotes self-discipline and responsibility</td>
<td>3.00</td>
</tr>
</tbody>
</table>
surprise most educators, most of these criteria relate directly to the affective growth of the student—an area often overlooked in the provision of educational services.

Data collection source two: Anecdotal notations

Defined as recorded accounts of data significant to the assessment process, this data collection source contains five classifications: (1) administrator, (2) parent, (3) student, (4) teacher, and (5) other. The teacher performance experts were asked to access each of these five as to its relative weight in the evaluation process. All responses were averaged and rounded to hundredths accuracy with those holding fives in the thousandth place rounded to the next higher integer. Non-responses were omitted from the calculation.

Table 2. Data Collection Source: Anecdotal Notations
Weights as Defined by Evaluation Experts

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrator</td>
<td>2.75</td>
</tr>
<tr>
<td>Parent</td>
<td>2.38</td>
</tr>
<tr>
<td>Student</td>
<td>3.75</td>
</tr>
<tr>
<td>Teacher</td>
<td>2.71</td>
</tr>
<tr>
<td>Other</td>
<td>3.60</td>
</tr>
</tbody>
</table>
In Table 2, teacher performance evaluation experts identified the following items under the classification "other": (1) valid measures of student achievement, (2) informed observer, usually instructional supervisor, and (3) teachers who are peers. Of all sources, student input was considered the most important (3.75) with other (3.60) sources (as identified above) being next in significance. Administrator input was weighted a point less in importance than input obtained from students.

Data collection source three: Student achievement data

Research indicates that student achievement data used for teacher evaluation must reflect day-to-day instructional priorities. Performance on norm-referenced tests is affected by too many factors beyond the control of the teacher and is too imprecise to be used as a performance indicator (Duke & Stiggins, 1986). Unfortunately, norm-referenced test data is often the only measurement of student achievement available. As such, this assessment algorithm component was designed to allow for the use of various data with the hope that supervisors would use that source which most accurately reflects teacher performance.

Performance experts were asked to determine what percentage of students should score above the 85th percentile on a norm-referenced or criterion-referenced test. These responses were used to define categories (Table 3) which were assigned a weight in the assessment algorithm.
Table 3. Data Collection Source: Student Achievement Data Weights as Defined by Evaluation Experts

<table>
<thead>
<tr>
<th>RANK</th>
<th>PERCENTAGE OF STUDENTS EXPECTED TO SCORE ABOVE THE 85TH PERCENTILE</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>17.0</td>
</tr>
<tr>
<td>Two</td>
<td>26.0</td>
</tr>
<tr>
<td>Three</td>
<td>38.0</td>
</tr>
<tr>
<td>Four</td>
<td>50.0</td>
</tr>
<tr>
<td>Five</td>
<td>62.6</td>
</tr>
</tbody>
</table>

The data indicate that the experts felt that teachers who had 62.6 percent of their students score above the 85th percentile were doing the best that could be expected. In descending order, the other categories were defined as follows: (1) Rank 4: 50% of the students must score above the 85th percentile; (2) Rank 3: 38% of the students must score above the 85th percentile; (3) Rank 2: 26% of the students must score above the 85th percentile; and (4) Rank 1: 17% of the students must score above the 85th percentile.

Two additional questions focusing on the use of achievement data for performance evaluation were directed to the experts. The first question concerned the appropriateness of using norm-referenced achievement data. Three of the specialists indicated they would use norm-referenced data as part of performance evaluation but seven
experts stated that they would not. Criterion-referenced test data were considered more appropriate for the purpose of evaluation than norm-referenced. Six of the experts indicated they would use criterion-referenced test data, while only four indicated they would not. Caveats relating to the use of criterion-referenced and norm-referenced test data were expressed by the specialists.

**Data collection source four: Performance record**

K-BAS uses the term performance record in reference to longitudinal data which depict previous teacher performance. The performance evaluation experts were asked to respond to two questions related to this data collection source. The first question focused on weight assignments for multi-year appraisal data. Nine of the ten specialists agreed that appraisal data should be weighted by its date of origination with older data receiving less weight than recent information. One expert disagreed but did not comment as to why. The second performance record data question asked the experts to indicate the number of years of data which they felt could be legitimately examined during the development of a summative evaluation. Responses, when averaged, indicated 3.4 years of archival data could be included in the evaluation. Based on these data, K-BAS was designed to accept three years of previous appraisals. Table 4 presents these results.
Table 4. Data Collection Source: Performance Record
Weights as Defined by Evaluation Experts

<table>
<thead>
<tr>
<th>YEARS SINCE ORIGINATION</th>
<th>ASSIGNED WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three</td>
<td>3</td>
</tr>
<tr>
<td>Two</td>
<td>4</td>
</tr>
<tr>
<td>One</td>
<td>5</td>
</tr>
</tbody>
</table>

**Data collection source five: Intervention ratings**

Defined as the outcome of assistance offered to the teacher in the form of one of several clinical techniques, e.g., written plans for improvement, conferences, classroom strategies, etc. The performance evaluation experts were asked to indicate the number of staff interventions which a supervisor should attempt during a calendar year as part of clinical supervision. Averaged responses indicated that 3.33 interventions should be made. Directed by these data, K-BAS was designed to accept three sets of intervention ratings.

The second question posed to experts concerning intervention ratings was what degree of success should be expected. Averaged responses from the specialists indicated that 2.6 successful interventions should occur in a given calendar year. Obviously, instructional effectiveness is improved if interventions attempted
result in a positive outcome for the teacher. The algorithm was designed to reflect this fact and portray data provided by the experts. Table 5 combines and presents these data.

Table 5. Data Collection Source: Intervention Ratings Weights as Defined by Evaluation Experts

<table>
<thead>
<tr>
<th>NUMBER OF INTERVENTIONS</th>
<th>EXPECTED SUCCESSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.33</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Data collection source six: Special conditions

For the purpose of this research, special conditions have been defined as positive or negative circumstances which could effect teacher performance. The evaluation experts were given nine conditions which warrant consideration as part of the summative evaluation. Research indicates that differing weights can be assigned to stressors present in life situations as each impacts emotional homeostasis to a different degree. In concurrence with this, the experts were asked to assign a weight to each of the identified special conditions. These weights were averaged and rounded to the nearest hundredth. In those cases where an evaluator failed to respond to a particular item, the data were averaged without the response. Table 6 presents the results obtained on this data collection source.

All weights function to increase the number of points awarded
to the performance score. Although seemingly contradictory, this design was purposefully chosen to perform the desired outcome. As total points increase in the performance score, the level of effectiveness increases correlationally. Teachers confronted with stressful situations are awarded additional credit to offset the loss of effectiveness which might have resulted from these special conditions. Conversely, teachers having received special recognition for outstanding performance also receive additional credit for their efforts.

Table 6. Data Collection Source: Special Conditions
Weights as Defined by Evaluation Experts

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>ASSIGNED WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death of family member</td>
<td>3.13</td>
</tr>
<tr>
<td>Birth within the family</td>
<td>1.75</td>
</tr>
<tr>
<td>Physical impairment of family member</td>
<td>2.50</td>
</tr>
<tr>
<td>Physical impairment of employee</td>
<td>4.13</td>
</tr>
<tr>
<td>Emotional disability within family</td>
<td>3.50</td>
</tr>
<tr>
<td>Emotional disability of employee</td>
<td>4.20</td>
</tr>
<tr>
<td>Recipient of major award</td>
<td>3.00</td>
</tr>
<tr>
<td>Major accomplishment of some kind</td>
<td>3.00</td>
</tr>
<tr>
<td>Marriage or Divorce</td>
<td>2.50</td>
</tr>
</tbody>
</table>

Findings indicate, that of the nine conditions, a birth in the
family (1.75) was expected to have least impact on performance. The experts found emotional disability of the employee (4.20) to impact performance to the greatest degree. Not all of the experts felt this collection source should be included in the algorithm. The source's inclusion, however, was supported by more than half of the respondents, the criterion level established for validation.

Reviewing data related to the nine conditions; five of the experts felt that all of the conditions warranted consideration, two indicated that five of the conditions deserved review, and three respondents stated that they would not use any of the conditions in preparation of a summative evaluation.

**Total Weighted Score**

Performance evaluation experts were asked to rate each of the six data collection sources as to its relative strength in the total assessment algorithm. Data recovered from this section were averaged in the same manner as all other data. The weights selected for each data source are presented in Table 7.

Data collection source weights were assigned as follows: (1) achievement data = 4.00; (2) performance evaluation criteria = 3.33; (3) performance record = 3.17; (4) intervention ratings = 2.83; (5) anecdotal notations = 2.50; and (6) special conditions = 1.67.

The emergence of achievement data as the most important source of information seems paradoxical to opinions expressed by the performance
Table 7. Total Algorithm Weights as Defined by Evaluation Experts

<table>
<thead>
<tr>
<th>DATA COLLECTION SOURCE</th>
<th>ASSIGNED WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Evaluation Criteria</td>
<td>3.33</td>
</tr>
<tr>
<td>Anecdotal Notations</td>
<td>2.50</td>
</tr>
<tr>
<td>Student Achievement Data</td>
<td>4.00</td>
</tr>
<tr>
<td>Performance Record</td>
<td>3.17</td>
</tr>
<tr>
<td>Intervention Ratings</td>
<td>2.83</td>
</tr>
<tr>
<td>Special Conditions</td>
<td>1.67</td>
</tr>
</tbody>
</table>

experts in the achievement data section of the questionnaire. It must be assumed that the status afforded this data collection source is given without the knowledge of how to measure its impact. As reviewed earlier, agreement was not reached on the type of assessment data to use—norm or criterion referenced.

Data obtained from the questionnaire appear to support these three statements: (1) student evaluations of teacher performance are of prime importance (anecdotal notations); (2) student achievement should be the primary tool used to evaluate teacher performance (total algorithm weights); and (3) students should be provided instructionally effective teachers above all other considerations (teacher performance evaluation criteria). These exciting conclusions focus on what should be the heart
of every educational system—the students.

Results from the questionnaire were used to design the knowledge base in K-BAS. Screen displays were created to present and request required information. Weights from each of the data collection sources were incorporated into the assessment algorithm. Data from the performance evaluation experts were adequate for the creation of the knowledge-based assessment system.

Comparative Analysis: Supervisor versus System Data

Two types of data were compiled and analyzed—those obtained from performance evaluators and those generated from the assessment algorithm by K-BAS. Methods used in the analysis of these data and a description of results is provided in this section.

Supervisor data

Five performance scenarios were sent to twelve performance evaluators. The five scenarios were designed to depict differing levels of instructional effectiveness. In this manner, it was hoped to establish a baseline and a ceiling for algorithm performance scores. The twelve evaluators asked to complete the scenarios were skillful supervisors trained in the teacher evaluation process.

During the month of February, twelve groups of five scenarios were mailed or given to colleagues and supervisors in the field. A set of instructions accompanied each scenario packet (Appendix N). Seven of the twelve scenario packets were returned for analysis.
Evaluators were asked to read each of the five performance scenarios, comment on how data would be used, and assign both a performance score (between one and 100) and a status recommendation to each portrayed teacher. Data captured from these scenarios were averaged and rounded to the nearest hundredth. Fives held in the thousandth place were rounded to the next highest integer.

To allow for a comparison of performance evaluator scores and algorithm scores, the score distribution resulting from evaluator data was subject to a linear transformation. This procedure was necessary because of the discrepancy found to exist between the algorithm scale (319.24 - 1414.36) and that given to evaluators as a guideline (0 - 100). Scores were transformed by adding the constant of 319.24 (to equate the base of evaluator scores to zero) and multiplying by the constant 10.95 (the difference between the base and ceiling of the algorithm scale). In this manner, although the mean and standard deviation were changed, derived scores maintained the same positions held in the first scale. Results obtained from each of the performance evaluators are presented in Tables 8 and 9.

The difference between the highest and lowest scores in each of the five scenarios is (in rank order) as follows: scenario two = 98.55, scenario three = 153.3, scenario one = 164.25, scenario five = 273.75, and scenario four = 547.50. These data closely reflect expected outcomes. Scenarios one, two, and three present grouped data depicting
Table 8. Evaluator Performance Scores (TRANSFORMED)

<table>
<thead>
<tr>
<th>EVALUATOR</th>
<th>SCENARIO ONE</th>
<th>SCENARIO TWO</th>
<th>SCENARIO THREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>428.50</td>
<td>1304.50</td>
<td>921.25</td>
</tr>
<tr>
<td>2</td>
<td>548.95</td>
<td>1392.10</td>
<td>1019.80</td>
</tr>
<tr>
<td>3</td>
<td>428.50</td>
<td>1359.25</td>
<td>866.50</td>
</tr>
<tr>
<td>4</td>
<td>592.75</td>
<td>1381.15</td>
<td>866.50</td>
</tr>
<tr>
<td>5</td>
<td>538.00</td>
<td>1403.05</td>
<td>871.98</td>
</tr>
<tr>
<td>6</td>
<td>505.15</td>
<td>1359.25</td>
<td>1019.80</td>
</tr>
<tr>
<td>7</td>
<td>528.25</td>
<td>1392.10</td>
<td>866.50</td>
</tr>
</tbody>
</table>
Table 9. Evaluator Performance Scores (TRANSFORMED)

<table>
<thead>
<tr>
<th>EVALUATOR</th>
<th>SCENARIO 4</th>
<th>SCENARIO 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>581.80</td>
<td>1085.50</td>
</tr>
<tr>
<td>2</td>
<td>976.00</td>
<td>986.95</td>
</tr>
<tr>
<td>3</td>
<td>592.75</td>
<td>1052.65</td>
</tr>
<tr>
<td>4</td>
<td>428.50</td>
<td>866.50</td>
</tr>
<tr>
<td>5</td>
<td>702.25</td>
<td>1140.25</td>
</tr>
<tr>
<td>6</td>
<td>943.15</td>
<td>965.05</td>
</tr>
<tr>
<td>7</td>
<td>649.25</td>
<td>979.15</td>
</tr>
</tbody>
</table>
extremes (one and two) or consensus three). Scenarios four and five received widely scattered ratings allowing for less agreement.

To allow for a comparative analysis of these data with those generated from the algorithm by K-BAS, scores were averaged using the same procedures described for the individual performance score calculations. These averages are depicted in Table 10.

Table 10. Evaluator Performance Score Averages

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PERFORMANCE SCORE</th>
<th>STATUS RECOMMENDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supervisor</td>
<td>510.01</td>
<td>Probation</td>
</tr>
<tr>
<td>Scenario 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supervisor</td>
<td>1370.20</td>
<td>Promotion</td>
</tr>
<tr>
<td>Scenario 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supervisor</td>
<td>918.90</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Scenario 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supervisor</td>
<td>696.24</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Scenario 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supervisor</td>
<td>1010.86</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>
Performance scores obtained from scenarios one (510.01), two (1370.20), and three (918.90) seem to support their design—that of establishing baseline, median, and ceiling scores for the algorithm. Scenarios four (696.24) and five (1010.86) produced performance scores falling between these key designators. Comments provided by the evaluators were lively and enlightening. For ease of understanding, comments have been grouped by scenario and are presented below.

Comments regarding the use and evaluation of data from scenario one were focused on the provision of due process. Data in the scenario were seen as artifactual evidence of substandard performance. Additional data requested in order to complete the summative evaluation included: a self-evaluation by the teacher; interviews; information on attendance, extra-curricular participation, professional involvement, and self-growth; and an indication as to whether counseling was being provided.

Evaluators indicated that the data contained in scenario two would be used to provide documentation for promotion and recognition. Data were evaluated as extremely positive and it was felt that public congratulations should be provided. It was suggested that this teacher be given the status of master teacher and used as a model for other staff members.

Data in scenario three suggested to evaluators a teacher satisfied with mediocrity and likely to suffer a decline in productivity. It was felt that immediate action was necessary to "get
this teacher off center." Recommendations included: reassignment, the establishment of new job targets and intensive intervention. This teacher was seen as a threat to total staff effectiveness as lethargy and homeostasis would be reinforced by this level of performance.

In scenario four, evaluators voiced concern over the deleterious effects of medical and emotional problems on this teacher's performance. The pronounced decline in performance led some to comment that although current problems were severe, this teacher was salvageable. Recommendations included: referral to a therapist, a medical leave of absence, termination, personal interviews with the teacher to obtain self-evaluation data and an investigation to determine if any criminal acts had been committed.

Evidence from scenario five suggested to evaluators inconsistent performance on the part of the teacher. It was felt that the data depicted an uneven pattern and was inconclusive. Evaluators were suspicious of the dramatic improvement in performance as recorded in multi-year appraisals and suggested that previous evaluations be carefully reviewed. Recommendations included: a self-evaluation, additional observations, development of new interventions, provision of external assistance, and participation in designated inservice activities.
System data

To test the feasibility of using an assessment algorithm for teacher performance evaluation, data assessed by the evaluators had to be similarly assessed by the algorithm. Therefore, data from the five performance scenarios were fed into the assessment algorithm via K-BAS. Performance scores resulting from each of the five scenarios can be found in Table 11.

Table 11. System Performance Score Averages

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PERFORMANCE SCORE</th>
<th>STATUS RECOMMENDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>system</td>
<td>405.76</td>
<td>Termination</td>
</tr>
<tr>
<td>Scenario 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>system</td>
<td>1311.42</td>
<td>Promotion</td>
</tr>
<tr>
<td>Scenario 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>system</td>
<td>926.42</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Scenario 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>system</td>
<td>884.66</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Scenario 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>system</td>
<td>879.44</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>
As these data were analyzed in K-BAS, scores were generated for each of the data collection sources. Tables 12 and 13 illustrate the disaggregated performance scores.

As would be expected, the algorithm generated the lowest (405.76) and highest (1311.42) performance scores for scenarios one and two, respectively. The performance score for scenario three (926.42) appears to represent a midpoint in the band of scores. Scenarios four (884.66) and five (879.44) yielded similar performance scores.

Disaggregated performance score data illustrates how points are distributed in the algorithm. Due to the number of items contained in it, the data collection source teacher performance evaluation criteria assumes a disproportionate amount of weight in the algorithm. The other five data collection sources contribute in a balanced manner to the point total.

Comparative analysis

Supervisor and system scores resulting from each of the five scenarios differed less than anticipated. Table 14 depicts these data.

It is apparent that differences between supervisor and system scores for each scenario varied greatly. The scenario performance score discrepancies are ranked as follows: scenario three = 7.52, scenario two = 58.78, scenario one = 104.25, scenario five = 131.42, and scenario four = 138.42. The two sources of data, K-BAS and performance evaluators evidenced the most agreement in the scenario depicting a Table 12. Disaggregated Performance Scores: Systems Data
Table 12. Disaggregated Performance Scores: Systems Data

<table>
<thead>
<tr>
<th>DATA SOURCE</th>
<th>SCENARIO 1</th>
<th>SCENARIO 2</th>
<th>SCENARIO 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Criteria</td>
<td>91.31 (3.33)</td>
<td>336.40</td>
<td>230.10</td>
</tr>
<tr>
<td>Anecdotal Notations</td>
<td>14.34 (2.50)</td>
<td>28.68</td>
<td>22.18</td>
</tr>
<tr>
<td>Intervention Ratings</td>
<td>3 (2.83)</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Achievement Data</td>
<td>2 (4.00)</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Special Conditions</td>
<td>4.88 (1.67)</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Performance Record</td>
<td>13 (3.17)</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Performance Score</td>
<td>405.76</td>
<td>1311.42</td>
<td>926.42</td>
</tr>
</tbody>
</table>

*Total algorithm weights for each data collection source are indicated in parentheses in the first column next to each of the six scores.
Table 13. Disaggregated Performance Scores: Systems Data

<table>
<thead>
<tr>
<th>DATA SOURCE</th>
<th>SCENARIO 4</th>
<th>SCENARIO 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Criteria</td>
<td>224.67 (3.33)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>211.24</td>
</tr>
<tr>
<td>Anecdotal Notations</td>
<td>23.18 (2.50)</td>
<td>22.55</td>
</tr>
<tr>
<td>Intervention Ratings</td>
<td>4 (2.83)</td>
<td>5</td>
</tr>
<tr>
<td>Achievement Data</td>
<td>3 (4.00)</td>
<td>5</td>
</tr>
<tr>
<td>Special Conditions</td>
<td>4.2 (1.67)</td>
<td>5.63</td>
</tr>
<tr>
<td>Performance Record</td>
<td>15 (3.17)</td>
<td>24</td>
</tr>
<tr>
<td>Performance Score</td>
<td>884.66</td>
<td>879.44</td>
</tr>
</tbody>
</table>

<sup>a</sup>Total algorithm weights for each data collection source are indicated in parentheses in the first column next to each of the six scores.
Table 14. Comparative Analysis: Supervisor and System Data

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PERFORMANCE SCORE</th>
<th>STATUS RECOMMENDATIONa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supervisor</td>
<td>510.01</td>
<td>Probation</td>
</tr>
<tr>
<td>system</td>
<td>405.76</td>
<td>Termination</td>
</tr>
<tr>
<td>Scenario 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supervisor</td>
<td>1370.20</td>
<td>Promotion</td>
</tr>
<tr>
<td>system</td>
<td>1311.42</td>
<td>Promotion</td>
</tr>
<tr>
<td>Scenario 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supervisor</td>
<td>918.90</td>
<td>Maintenance</td>
</tr>
<tr>
<td>system</td>
<td>926.42</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Scenario 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supervisor</td>
<td>696.24</td>
<td>Maintenance</td>
</tr>
<tr>
<td>system</td>
<td>884.66</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Scenario 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supervisor</td>
<td>1010.86</td>
<td>Maintenance</td>
</tr>
<tr>
<td>system</td>
<td>879.44</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>

aCutting points established as follows: 319.24 - 428.75 = termination, 428.76 - 538.26 = probation, 538.27 - 1304.84 = maintenance, and 1304.85 - 1414.35 = promotion.
medium level of effectiveness. In scenario four, which depicts a teacher experiencing severe emotional and physical problems, the two sources differed markedly.

The data illustrate expected outcomes. Performance scores from scenarios one (104.25) and two (58.78) would have been expected to experience the least amount of difference. These scenarios depict extremes in performance and should have allowed for more exacting ratings on the part of evaluators. Scenarios three, four, and five all depict a more scattered wide-ranging set of behaviors at various levels of effectiveness. Speculation would have been that evaluators would find it more difficult to reach consensus on data of these type. Obviously, scores obtained on scenario three violate these expectations.

The assessment algorithm, given the weighted data, allows for a maximum score of 1414.36 and a minimum score of 319.24. As these represent severe extremes in performance, it is doubtful that either of these scores would appear often. These scores do, however, provide the basis for designation of status categories.

A comparative analysis of data provided by performance evaluators and experts must include a discussion of both performance scores and status recommendations. The evaluators were provided minimal guidelines concerning development of scenario performance scores. Performance scores were converted to fit the scale defined by the experts for the assessment algorithm. The resultant values have already been reviewed.
The wide discrepancy between performance scores in scenario four remains unexplained. The design of the scenario, e.g., the inclusion of highly emotional issues, may be responsible for these results. To assure that accurate decisions had been made in all of the five scenarios, it would be necessary to achieve a reduction in the degree of interscore differences. This reduction in error could be attained through refinement of supervisor skills as identified by numeric values provided by an algorithm.
CHAPTER V. CONCLUSIONS

In this chapter, discussion will focus on summary statements providing review of this dissertation, conclusions which can be drawn from the results of this research, limitations in research design, and recommendations related to future research efforts.

Summary

In an attempt to test the feasibility of designing a knowledge-based system which would assist in teacher performance evaluation, this research was undertaken. To establish a structure for this system, it was first necessary to examine research related to teacher performance evaluation. Because the system was to provide assistance in evaluation, it was essential to identify both the process and components involved in completion of this task.

The review of literature revealed a need for definition of data collection sources, a group of informational resources (sometimes referenced as a database) used during development of the summative evaluation. A pool of potential data sources was submitted to a jury of performance evaluation experts for validation. The same group of experts was asked to weight each of the selected sources thereby defining its impact in the summative evaluation. Identified data collection source weights were placed in an algorithm which served as the knowledge-base for the design of a knowledge-based expert system named K-BAS. The resultant equation was:
(TPEC AGS) (W) + (IR AGS) (W) + (SC AGS) (W) + (PR AGS) (W) + (SAD AGS) (W) + (AN AGS) (W) = TWC

Equation variables are defined as follows: (1) AGS = the aggregate summative rating produced from each data collection source; (2) W = weight assigned to each data collection source; (3) TWC = the total weighted calculation, obtained by summing aggregate totals multiplied by their respective weights; (4) TPEC = teacher performance evaluation criteria; (5) IR = intervention ratings; (6) SAD = student achievement data; (7) SC = special conditions; (8) AN = anecdotal notations; and (9) PR = performance record.

Created from the data provided by the performance evaluation experts, K-BAS is a hybrid. K-BAS is a combination of conventional programming techniques and captured expertise. The system allows for the analysis of data and for assistance in decision-making—thus distinguishing it from typical software programs.

K-BAS requests supervisors to input performance evaluation data. The system processes these data using an algorithm created by the weights assigned by the jury of performance evaluation experts. K-BAS produces a performance score and a corresponding effectiveness classification from input data.

Specific data analysis procedures were designed to test the feasibility of using a system of this type for teacher performance evaluation. Five performance scenarios, textual descriptions of teacher performance including archival data, were distributed to
a selected group of performance evaluators. Seven evaluators rated the effectiveness of teachers portrayed in each of the five situations, assigned performance scores, and selected appropriate effectiveness classifications.

To provide for a comparative analysis, the five scenarios were evaluated by the assessment algorithm in K-BAS. Data obtained from both sets of evaluations—performance specialists and system generated—were compared. Differences detected between the two data sets were analyzed and explanations proposed.

Conclusions made from findings in the research indicate: (1) knowledge-based systems for the purpose of teacher performance evaluation can be designed, (2) it is possible to quantify qualitative data related to teacher performance evaluation, (3) decision-making tools can assist in teacher performance evaluation, and (4) performance evaluation experts are skeptical as to the value of knowledge-based expert systems for performance evaluation.

Limitations encountered during research efforts concerned the sensitivity of teacher performance evaluation as a test of artificial intelligence. Other limitations involved the availability of resources, time, and research in the area of artificial intelligence. Recommendations were structured to address this issue and provide direction for future research efforts.
Conclusions

Structured as a feasibility study, conclusions drawn from this research were expected to be more global than those attainable from an empirically based effort. The principal value of these conclusions will be to direct future investigations into this topic area.

As a result of this research, three conclusions appear to be justified: (1) decision-making tools can assist supervisors in teacher performance evaluation, (2) it is possible to quantify qualitative data related to teacher performance evaluation, (3) knowledge-based systems for the purpose of teacher performance evaluation can be designed, and (4) teacher performance evaluation experts are skeptical as to the value of knowledge-based expert systems for teacher performance evaluation.

These conclusions result from answers to questions posed in Chapter I. Findings indicate that these questions can be addressed in the following manner:

• What components does a performance evaluation decision-making tool need? This research indicates that an effective tool would have: (1) a well-defined knowledge base, (2) concisely structured rules, (3) supportive documentation and paperware, and (4) a user-friendly structure.

• Which data collection sources would be selected by the performance evaluation experts as critical to the
assessment process? The jury of experts selected six data collection sources: (1) teacher performance evaluation criteria, (2) anecdotal notations, (3) intervention ratings, (4) achievement data, (5) special conditions data, and (6) performance record.

* How would the weights of components in the data collection sources be distributed by the performance evaluation experts? Internal categories and classifications can be referenced in Chapter IV of this dissertation. The six data collection sources were weighted as follows: (1) teacher performance evaluation criteria = 3.33, (2) anecdotal notations = 2.50, (3) intervention ratings = 2.83, (4) achievement data = 4.00, (5) special conditions data = 1.67, and (6) performance record = 3.17.

* How would performance evaluators assess the effectiveness of teachers depicted in the hypothetical scenarios? Results and corresponding effectiveness classifications were as follows: (1) scenario one = probation, (2) scenario two = promotion, (3) scenario three = maintenance, (4) scenario four = maintenance, and (5) scenario five = maintenance.

* How would the Knowledge-Based Assessment System (K-BAS) assess the effectiveness of teachers depicted in the
five hypothetical scenarios? Results and corresponding effectiveness classifications are as follows: (1) scenario one = termination, (2) scenario two = promotion, (3) scenario three = maintenance, (4) scenario four = maintenance, and (5) scenario five = maintenance. Simple inspection indicates that effectiveness classifications assigned by both evaluators and performance experts differed in only the first scenario. In this instance, it appears that performance experts have higher expectations for teacher performance than evaluators.

- Will the data obtained from the performance evaluators differ from those K-BAS provides? The algorithm, as processed by K-BAS, assigned a lower effectiveness classification in scenario one than the performance evaluators. This allows for the possibility that expectations held by performance experts may differ from those of evaluators in the field when decisions involving termination are to be made. Both groups assigned the same effectiveness classifications to the other four scenarios. More research needs to be done in this area.

- A knowledge-based system would be more acceptable in a less sensitive area of administration.

- The algorithm represents the collective expertise of
ten performance evaluation experts. Additional research needs to be undertaken to define its value in teacher performance evaluation.

**Limitations**

Limitations encountered during this investigation concerned the availability of resources, time, and research in the area of artificial intelligence. The most powerful limitation being that teacher performance evaluation is an emotionally laden area in which to test artificial intelligence. Unfortunately, this is the area known best by this researcher so it presented the most logical to use for this investigation.

This developmental exercise involved many complex pieces requiring extensive investigation. Of primary importance was the need of the researcher to understand the science of artificial intelligence. Although research in the area of artificial intelligence began almost thirty years ago, applications of it are of recent origin. Few operational models depicting the structure desired for a system of the type created in this research were available for review. Fuzzy definitions and lack of definition in general further complicated developmental efforts.

It was discovered during the development of K-BAS that to effectively design a knowledge-based expert system for teacher performance evaluation, a knowledge base containing a significant number of rules would be required. Artificial intelligence shells
allowing for entry of the number of rules this researcher estimates would be required cost between $3,000 to $60,000. This obviously proved to be a limitation which needs to be addressed in future research efforts.

Another limitation appearing during development of K-BAS, concerns the structuring of a knowledge-base for teacher performance evaluation. It is this researcher's opinion that a large group of individuals would be needed to examine all of the processes involved and construct appropriate rules for teacher performance evaluation. The amount of time needed to complete this task would be immense.

Because of the complex nature of this effort, a large proportion of available time was devoted to development of the product. This disallowed for extensive testing of the system, an obvious limitation. Additional field tests need to be conducted.

The most important limitation encountered in this research concerns the nature of the area chosen for investigation and product development. Teacher performance evaluation is a sensitive issue. To suggest this process could be effectively quantified or encapsulated in a system capable of assisting in decision-making violates tenaciously held beliefs and affronts the sensitivities of many.

Two final limitations must be noted. It was found there exists among experts disagreement on what constitutes effective
teacher performance evaluation. This one fact, more than any others, suggests that the process of teacher performance evaluation is as yet not defined with enough precision to allow for the development of an expert system. Perhaps because of this, some experts and evaluators asked to provide information for this research voiced skepticism as to its feasibility. This served to color perspectives and responses obtained from the questionnaires and on scenarios.

Discussion

When K-BAS is juxtaposed to the Computer-Assisted Teacher Evaluation and Supervision (CATE/S) software, and a medical diagnosis system named Caduceus, many parallels emerge. One of the most important of these involves the reticence of supervisors to accept assistance from microcomputers. Currently, suspicion and caution dominate use. If technological transformation is to be realized, these attitudes must change.

Caduceus, a decision-making software program developed at the University of Pittsburgh, allows physicians to receive medical diagnoses from data submitted to the system for analysis. Decisions provided by Caduceus are extremely accurate, yet physicians still voice skepticism about its value as a diagnostic tool. The physicians need to feel ownership for the diagnosis and to feel it resulted from experiential knowledge seems to supersede the need for quick, and perhaps, more accurate decisions.

CATE/S and K-BAS face obstacles different from those Caduceus
will experience because of the environment in which they were designed to function. To provide for increased acceptance of technology in school management, the following need to occur: (1) informative discussions emphasizing practical applications of these technologies, (2) opportunities for exposure and "hands on" activities, (3) the creation of "support" groups designated solely for administrative access, and (4) a revision of administrator preparatory programs allowing for the inclusion of technological applications in the field. Until supervisors acknowledge the value of technological applications, actively promote use of innovative programs, and demonstrate implementation as a priority through the provision of financial and time resources, efforts to technologically transform educational environments will be stymied.

Findings from this research not only reflect the reticence among supervisors to make use of microcomputers (or for that matter mini or mainframe systems), but also the lack of confidence afforded reports or data generated from this hardware. Software programs, still considered by some supervisors as "black smoke, magic and mirrors," are viewed with suspicion. Decisions produced by these programs are often seen as "magic bullets" lacking substance. As more software is produced and use increases, these myths may be dispelled. At this point in time, the ability of software programs to assist in decision-making is limited.

These two findings, the reticence of supervisors to use
microcomputers and the lack of confidence afforded reports or decisions provided through use of software programs, exist primarily because of time constraints disallowing supervisors access to training and practice, self-imposed attitudinal constraints and the relative newness of the topic area. These issues, until addressed, will continue to plague efforts directed to technological transformation.

CATE/S, K-BAS, and Caduceus represent departures from software currently available. Responses from performance experts contributing to the creation of K-BAS, evidenced concern over the development of a system which quantifies or narrows to any degree the number of options available to a supervisor in teacher performance evaluation. Perhaps the conclusion will be made that only specific functions are amenable to embodiment in an expert system. To curtail the number of possible options available to supervisors could violate the essence of teacher performance evaluation.

As more sophisticated expert systems are designed, capable of learning from mistakes and restructuring internal knowledge bases to reflect this new knowledge, the argument could be posed that this "machine intelligence" will be superior to that of its human counterpart. Future developmental efforts and supervisor attitudes will determine which of these two potentials becomes reality.
Recommendations

Recommendations which seem germane to this research fall into these categories: (1) developmental caveats, (2) knowledge-based expert system components, and (3) related research questions.

Given the opportunity to replicate this research, certain methodologies used in the completion of this investigation would be altered. Revisions primarily involve design aspects of the testing phase and include: (1) further definition of data collection source components, (2) a reduction in the number of performance experts contributing to the knowledge base, (3) a more in-depth interview with performance experts, (4) a redesign of the performance scenarios to include more concise definition of teacher behaviors, and (5) a larger sampling of performance evaluators. These revisions would provide refinement to data elements allowing for a more valid and reliable assessment of the effectiveness of the algorithm.

From this research come many recommendations for the redesign of K-BAS and for future versions of performance evaluation expert systems. K-BAS represents an elementary version of the type of product which will eventually emerge. K-BAS should not be used in its present form for teacher performance evaluation. Developmentally, it is an infant with many years of growth and change ahead of it. It is also a small-scale system developed under tight time constraints, on a low budget, and without the assistance of a research team.

To develop the most effective tool to assist in teacher performance
evaluation, large-scale systems must be considered. The potential impact a large-scale system could have on educational productivity warrants its development. Given adequate time, as well as financial and human resources, an expert system could be designed which would learn from its own mistakes, provide prescriptive interventions, and analyze individual learning styles. Linked to powerful databases and a sophisticated communications network, this software would become a critical resource in teacher performance evaluation.

Through some minimal redesign, a more sophisticated and sleek version of K-BAS could be achieved. Screen displays could be enhanced through the use of appropriate graphics. User friendliness could be improved by some recoding of data entry sections and dramatically improved by allowing for voice activation. Improved storage and retrieval of data would be a mandatory revision were the system to ever be of commercial value.

The design of K-BAS cracks the door to the world of expert systems research in education. A wealth of research questions abound each splintering off into a series of additional queries. Related research efforts should primarily focus on the impact of knowledge-based systems on teacher performance evaluation. Longitudinal empirically designed studies and field testing of K-BAS are drastically needed.

Questions which seem appropriate include: (1) Can the use of a decision-making tool result in more accurate teacher performance evaluation? (2) Will supervisors and teachers accept knowledge-based
systems and the decisions they make? (3) Can performance scores generated from the algorithm be successfully matched to teacher effectiveness classifications? (4) Is it possible to quantify all of the behaviors operational in an instructionally effective teacher? (5) Which domain expert's knowledge should be captured for the knowledge base of a performance evaluation expert system? Does a performance evaluation expert exist whose beliefs are universally accepted or would we have the "Rosenshine Expert System" and the "Lezotte Expert System" among others? (6) Is consistency in teacher evaluation procedures a desirable goal or should an allowance be made out of respect for the "art" of the process? (7) What role will achievement data have in the determination of instructional effectiveness?

It will be interesting to observe as research efforts related to these recommendations are undertaken. Many provocative and challenging investigations will yield exciting, creative theories and products.
BIBLIOGRAPHY


APPENDIX A: COGNITIVE PROCESSING CENTERS
Facilitators:

Cognitive Programmers

Consultants

Coordinators

Functions

Cognitive Programmers: Educational background—Training develops cognitive field expertise, not subject matter specialists. Exposure to a generalist program with specialization occurring within areas such as management information systems or learning theory.

Responsibilities—Charged with the task of prescriptive program plan development utilizing knowledge-based system, coordination of mechanics of program plans (data base linkages), and configuration of program logistics (scheduling: home terminal/on-site session, timelines, assessment procedures).

Consultant: Educational background—Training is in any area in which prescriptive programming will occur. This individual should have obtained optimal stature in his/her chosen career field.

Responsibilities—This individual will function as a domain expert, knowledge will be extracted from him/her and embedded into the knowledge base within the prescriptive program plans. This person will also hold teleconferences with clients, allow for shadowing, and provide assistance in the placement process.

Coordinators: Educational background—Appropriate fields would include business management, finance, public relations, management information systems, and artificial intelligence.

Responsibilities—This individual will coordinate system finance, complete assessment activities as related to program and personnel (with assistance of knowledge-based systems), develop client
recruitment strategies and function as a systems expert. It would be expected that in the future this position will be held by a machine or at least the majority of these functions will be assumed by such and implemented by a human.

**Client Programming Options**

Cognitive Processing Center:

An operational definition: An integrated set of data bases coupled with knowledge-based systems designed to provide prescriptive programming plans aimed at promoting educational growth for individual clients. These centers are private entrepreneurial ventures sustained by client tuition, the securement of competitive grants/endowments, and investment strategies.

Client Programming Options:

Prescriptive Programming Plans (P.P.P.): A structured, specifically delineated plan developed from integration of the following variables: client occupational goal, client learning profile, and past performance indicators. Packages are configured by cost and offer differing options. Package content is predicated upon age of client, two basic age groupings exist. Example below:

**Age 4-10 Developmental Curriculum**
(Genetic engineering will provide us with a different type of child than we presently work with)

*designed to meet individual learning profile
*modification - system reconfiguration, retracking correlated to client needs and sensitive to economic, and social conditions.
*comparative progress analysis - international/national/state and local norming available
*daily progress profiles telematically transmitted to home CRT.

**Age 11-18**

*creates linkages for placement - networked with all Fortune 500 companies
*networked with technical centers
SAMPLE PROGRAMMING PACKAGES:

Prescriptive Programming Package A:

Annual fee of $5000.00 - Corporate sponsorships available

Benefits:

* dialogues with domain experts
* teleconference options
* surrogate travel to selected sites
* comparative progress analysis
* core package of critical thinking skills
* system retracking
* learning profile used in program design
* predictive capabilities constantly analyze occupational trends / client progress and revise P.P.P. to reflect projections
* guaranteed mastery of six instructional units in one person year
* domain specific group interactional sessions
* "Study with the Master" series : pursue eclectic interests (music, art, athletics, etc.)

Prescriptive Programming Package B:

Annual fee of $2500.00

Benefits:

(This program would not be as individualized as the above. Options would be of a more generic nature; i.e. videotape presentations in lieu of teleconferencing. Mastery guarantees are predicated upon longer processing time.)
ADVERTISING STRATEGIES:

Walk With the Wizard Cognitive Programming Center

*Access to the most powerful data base configuration available
*Placement Profile (percentage of clients placed in chosen occupational areas) rivaled by none.
*Most efficient transmittal systems available - all modems 1200 baud, 14Mhz microprocessors
*Voice synthesis in six languages
*Flexible payment plans; center investment option
* Ratings of cognitive programmers
APPENDIX B: WORKSTATION SCHEMATICS
PLEASE NOTE:

Copyrighted materials in this document have not been filmed at the request of the author. They are available for consultation, however, in the author's university library.

These consist of pages:

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APPENDIX C: LOCAL AREA NETWORK
APPENDIX D: EDUCATIONAL DATABASES
COGNITIVE PROCESSING CENTER
INFORMATIONAL INFRASTRUCTURE

COMMUNITY DATA
FINANCIAL DATA
PERSONNEL DATA
CLIENT DATA

NATIONAL, STATE, INTERNATIONAL DATA SYSTEMS
FACILITIES DATA

MASTER DATA BASE
APPENDIX E: DATABASE MODULES DEFINED
INFORMATIONAL INFRASTRUCTURE
NATIONAL, STATE, INTERNATIONAL DATA SYSTEMS

COMPUSERVE/THE SOURCE
REGENTS / PRIVATE UNIVERSITIES
AREA COMMUNITY COLLEGES
LIBRARY SYSTEM
OTHER LOCAL PROCESSING CENTERS
AREA PROCESSING CENTERS
RESEARCH CENTERS
BUSINESS NETWORKS
NEA / NASSP / AFT / OTHER ORGANIZATIONS
MEDIA / PBS, OTHER EDUCATIONAL NETWORKS
SPECIALIZED TRAINING PROGRAMS

EXPERT SYSTEM
PREDICTIVE CAPABILITIES

SCHEDULE OF DAILY TASKS
INFORMATIONAL "PULLS"
COMMUNICATIONS / MEMO'S
SYSTEM ALERTS/FAILURES
MATCH CLIENT PROGRAMS TO:
AVAILABLE "EXPERTS",
LEARNING SITUATIONS,
SURROGATE TRAVEL OPTIONS
INFORMATIONAL INFRASTRUCTURE

CLIENT DATA

- AFFECTIVE DATA
- PERFORMANCE DATA
- DEMOGRAPHIC DATA
- PROGRAM PLAN DATA
- CLIENT LEARNING PROFILES

EXPERT SYSTEM

- OPTIMAL SCHEDULING
- STAFF/CLIENT MATCH
- ASSESS/MODIFY ALL CLIENT PROGRAMS
  - PRESCRIPTIVE/DIAGNOSTIC
  - PROGRAMMING OPTIONS = PRESCRIPTIVE
  - PROGRAM PLANS (P.P.P.)

DEVELOPED BY PROCESSING:

- OCCUPATIONAL GOALS
- LEARNING PROFILE
- PERFORMANCE DATA
INFORMATIONAL INFRASTRUCTURE
COMMUNITY DATA

COMMUNITY DATA

DEMOGRAPHICS
VOTING RECORDS
INDIVIDUAL PROFILES

EXPERT SYSTEM

MOST EFFECTIVE MARKETING STRATEGIES

POLICY DECISIONS

RESOURCES: MONETARY AND COGNITIVE
INFORMATIONAL INFRASTRUCTURE

PERSONNEL DATA

DEMOGRAPHICS
SUMMATIVE (INTERNATIONAL RANKINGS)
FORMATIVE
ANECDOTAL NOTATIONS
INTERVENTIONS
OTHER DATA

EXPERT SYSTEM

→ PERFORMANCE EVALUATION OPTIONS
→ OPTIMAL STAFF ASSIGNMENTS
→ OPTIMAL SCHEDULING PARADIGM
→ PRESCRIPTIVE / DIAGNOSTIC PROGRAMMING OPTIONS

→ SPECIALIZED PROGRAM PACKETS
DEVELOPED BY PROCESSING:
IDENTIFIED PERFORMANCE DEFICITS
LEARNING PROFILE
LEVEL OF REMEDIATION INDICATED
INFORMATIONAL INFRASTRUCTURE

FINANCIAL DATA

ACCOUNTS EQUIVALENT TO GENERAL FUND:
ACTIVITY FUND:
SECRETARY'S ANNUAL ACCOUNT.

EXPERT SYSTEM

GRANTS/MONETARY RESOURCES TO PURSUE
INVESTMENT STRATEGIES
ALLOCATION OF AVAILABLE MONIES
INFORMATIONAL INFRASTRUCTURE
FACILITIES DATA

- SIZE
- TYPE
- LOCATION
- AGE
- CONFIGURATION

EXPERT SYSTEM

- MAINTENANCE DECISIONS
- MANAGEMENT DECISIONS
- ASSIGNMENT / USAGE
- ADVISE ON CONSTRUCTION
- ADVISE ON RECONFIGURATION
APPENDIX F: PERFORMANCE SITUATIONS REQUIRING
JOB OR PERFORMANCE AIDS
<table>
<thead>
<tr>
<th>IF</th>
<th>THEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response speed is more important than accuracy</td>
<td>Memorize the response (e.g. through</td>
</tr>
<tr>
<td>The task is performed frequently</td>
<td>instruction or CAI)</td>
</tr>
<tr>
<td>Small errors won't have large consequences</td>
<td></td>
</tr>
<tr>
<td>Reading instructions would interfere with performance</td>
<td></td>
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<tr>
<td>Job prestige requires a memorized response</td>
<td></td>
</tr>
<tr>
<td>IF</td>
<td>THEN</td>
</tr>
<tr>
<td>Response speed isn't as important as accuracy</td>
<td>Use job aids</td>
</tr>
<tr>
<td>(small errors have large consequences)</td>
<td></td>
</tr>
<tr>
<td>Tasks are performed infrequently</td>
<td></td>
</tr>
<tr>
<td>Reading instructions won't interfere with performance</td>
<td></td>
</tr>
<tr>
<td>The task involves a complex decision-making process</td>
<td></td>
</tr>
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</table>
APPENDIX G: AN OVERVIEW OF THE KEY EVENTS IN THE HISTORY OF ARTIFICIAL INTELLIGENCE
<table>
<thead>
<tr>
<th>Period</th>
<th>Key Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-World War II roots</td>
<td>Formal logic</td>
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<tr>
<td></td>
<td>Cognitive psychology</td>
</tr>
<tr>
<td>The postwar years, 1945–1954</td>
<td>Computers developed</td>
</tr>
<tr>
<td>Pre-AI</td>
<td>H. Simon, <em>Administrative Behavior</em></td>
</tr>
<tr>
<td></td>
<td>N. Wiener, <em>Cybernetics</em></td>
</tr>
<tr>
<td></td>
<td>A. M. Turing, &quot;Computing Machinery and Intelligence&quot;</td>
</tr>
<tr>
<td></td>
<td>Macy Conferences on Cybernetics</td>
</tr>
<tr>
<td>The formative years, 1955–1960</td>
<td>Growing availability of computers</td>
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<tr>
<td>The initiation of AI research</td>
<td>Information Processing Language I (IPL-1)</td>
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<tr>
<td></td>
<td>The Dartmouth Summer Seminar on AI, 1956</td>
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<tr>
<td></td>
<td>General Problem Solver (GPS)</td>
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<td></td>
<td>Information processing psychology</td>
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<td>The search for general problem solvers</td>
<td>LISP</td>
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<td>Heuristics</td>
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<td>Satisficing</td>
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<td></td>
<td>Robotics</td>
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<td></td>
<td>Chess programs</td>
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<tr>
<td></td>
<td>DENDRAL (Stanford)</td>
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<td>The years of specialization and success, 1971–1980</td>
<td>MYCIN (Stanford)</td>
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<tr>
<td>The discovery of knowledge-based systems</td>
<td>HEARSAY II (Carnegie-Mellon)</td>
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<td></td>
<td>MACSYMA (MIT)</td>
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<td></td>
<td>Knowledge engineering</td>
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<td></td>
<td>EMYCIN (Stanford)</td>
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<td>GUIDON (Stanford)</td>
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<td></td>
<td>PROLOG</td>
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<td></td>
<td>Herbert Simon—Nobel Prize</td>
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<td>The rush to applications, 1981–</td>
<td>PROSPECTOR (SRI)</td>
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<tr>
<td>International competition and commercial ventures</td>
<td>Japan's Fifth-Generation Project</td>
</tr>
<tr>
<td></td>
<td>E. Feigenbaum and P. McCorduck, <em>The Fifth Generation</em></td>
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<tr>
<td></td>
<td>U.S.'s Microelectronics &amp; Computer Technology Corp. (MCC)</td>
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<tr>
<td></td>
<td>INTELLECT (A.I.C.)</td>
</tr>
<tr>
<td></td>
<td>Various corporate and entrepreneurial AI companies</td>
</tr>
</tbody>
</table>
APPENDIX H: THE ARCHITECTURE OF A KNOWLEDGE-BASED EXPERT SYSTEM
APPENDIX I: FLOWCHARTS
DATA COLLECTION SOURCE ONE:
TEACHER PERFORMANCE EVALUATION CRITERIA

START

Determine the Aggregate Data Sum

Read R

R > 0 and R < 5

FALSE

Read C

TRUE

Read R

R > 0 and R < 5

Read C

\[ \sum R \times C = A \]

Read W

A \times W = T

STOP

R - Rating for each criterion
C - Weight for each criterion
A - Aggregate sum
W - Criterion weight in total algorithm
T - Total Algorithm Performance Score

Use assigned criterion weight to develop total algorithm performance score
Determine the Aggregate Sum

START

Read D

Read S

TRUE

S > 0 and S < 3

Sum all D x S = A1

Read W1

A1 x W1 = T1

STOP

FALSE

D = Data Rank
S = Data Status
A1 = Aggregate Sum
W1 = Criterion Weight in Total Algorithm
T1 = Total Algorithm Performance Score
DATA COLLECTION SOURCE THREE: INTERVENTION RATINGS

START

Determine the Aggregate Data Sum

Read S

S > 0 and S < 3

TRUE

S = Data Status
A2 = Aggregate Sum
W2 = Criterion Weight in Total Algorithm
T2 = Total Algorithm Performance Score

FALSE

ΣS = A2

Use assigned criterion weight to develop total algorithm performance score

Read W2

A2 x W2 = T2

STOP
Determine Aggregate Sum Achievement Data

START

D = Data Rank
W3 = Criterion Weight in Total Algorithm
T3 = Total Algorithm Performance Score

Read D

D > 0 and D < 6

TRUE

Read W3

D x W3 = T3

STOP

FALSE

Use assigned criterion weight to develop total algorithm performance score
DATA COLLECTION SOURCE FIVE:
SPECIAL CONDITIONS DATA

START

Determine the Aggregate Sum

Read D

Σ D = A4

Use assigned criterion weight to develop total algorithm performance score

Read W4

A4 x W4 = T4

STOP
Determine the Aggregate Sum

D = Data Rank
S = Status
A5 = Aggregate Sum
W5 = Criterion Weight
T5 = Total Algorithm Performance Score

START

Read D

D > 0 and D < 6

Read S

S > 0 and S < 3

Sum all D x S = A5

Read W5

A5 x W5 = T5

STOP

Use assigned criterion weight to develop total algorithm performance score
APPENDIX J: KNOWLEDGE BASE DESIGN TOOL
A review of the literature has allowed for the identification of six data collection sources. (Four cited within the newly released Teacher Evaluation: Five Keys to Growth, Duke & Stiggins, 1986) Definitions of each ensue:

**Teacher Performance Evaluation Criteria:** Indices of instructional effectiveness;

**Anecdotal Notations:** Recorded accounts of data significant to the assessment process

**Student Achievement Data:** Norm-referenced or criterion-referenced statistical analysis depicting the degree to which students have mastered stated objectives

**Performance Record:** Longitudinal data depicting previous teacher performance

**Special Conditions Data:** Positive or negative circumstances which could effect performance

**Intervention Ratings:** Any one of several clinical techniques, e.g., conferences, written plans for improvement, classroom strategies

Data Collection Source One: Teacher Performance Evaluation Criteria

Selected because of its extensive research-base, twenty teacher performance criteria developed at Iowa State University (Clinical Manual for Teacher Performance Evaluation, Manatt & Stow, 1984) will be used within this algorithm.

Please rate each of the following criteria as to its ability to act as a discriminating index of staff performance. The 20 items are to be rated between 1 and 5 as to their perceived weight within the performance evaluation process. Consider 5 indicative of optimal discriminatory ability. Duplication of ratings is permissible.

1. Demonstrates effective planning skills
2. Implements the lesson plan
3. Motivates students
4. Communicates effectively with students
5. Provides students with specific evaluative feedback
6. Prepares appropriate evaluation activities
7. Displays a thorough knowledge of curriculum and subject matter
8. Selects learning content congruent with the prescribed curriculum
9. Provides opportunities for individual differences
10. Ensures student time on task
11. Sets high expectations for student achievement
12. Plans for and makes effective use of time, materials and resources
13. Demonstrates evidence of personal organization
14. Sets high expectations for student behavior
15. Organizes students for effective instruction
16. Demonstrates effective interpersonal relationships with others
17. Demonstrates awareness of the needs of students
18. Promotes positive self-concept
19. Demonstrates sensitivity in relating to students
20. Promotes self-discipline and responsibility

Data Collection Source Two: Anecdotal Notations

Many variables affect instructional effectiveness (A.A.S.A., 1986). To assure that all indices of performance are considered during the evaluation process, it is necessary to compile data of all types from all available sources.

Please rank 1 to 5 each of the following sources of performance evaluation data as to their relative weight within the evaluation process. Use a 5 to indicate that source warranting the most consideration.

Administrator
Parent
Student
Teacher
Other (please identify)
Data Collection Source Three: Student Achievement Data

Research indicates that student achievement data must reflect day-to-day instructional priorities. Performance on norm-referenced tests is affected by too many factors beyond the control of the teacher and is too imprecise to be used as a performance indicator. (Teacher Evaluation: Five Keys to Growth, Duke & Stiggins, 1986) As such, many options were considered during the design of this data source. It has been purposely left open-ended to allow for the entrance of those type of data available to the supervisor.

Please assign to each given rank the percentile of students you feel should score above the 85th percentile. (Note: composite score on NRT or CRT data) Consider 5 as indicative of the best performance. Please hierarchially sequence your percentiles.

Example: If you feel that 80% of a teacher's students should score above the 85th percentile in order for that teacher to receive the highest rank on this item, you would record such. Rank two might be recorded as "60% of students should score above the 85th percentile" with the other ranks following in same manner.

Rank 1 _____ of students should score above the 85th percentile
Rank 2 _____ of students should score above the 85th percentile
Rank 3 _____ of students should score above the 85th percentile
Rank 4 _____ of students should score above the 85th percentile
Rank 5 _____ of students should score above the 85th percentile

Do you feel it is appropriate to use NRT data taken from the teacher's speciality area for teacher evaluation?

yes no

Do you feel that an aggregate student gain score obtained from CRT would be an appropriate source of data for teacher evaluation?

yes no
Data Collection Source Four: Performance Record

Should one's past performance be taken into account during a summative evaluation? Are these data factored in whether they are acknowledged or not? Once again, research indicates consideration of all available data results in the most reliable evaluation.

Please indicate if you feel multi-year performance appraisal data should be weighted by its data of origination, e.g., data collected from three years ago is worth less than that collected two years ago.

yes no

Please indicate the number of years of performance data you feel a supervisor could legitimately examine when developing a summative evaluation.

5 4 3 2 1 0

Data Collection Source Five: Intervention Ratings

There is general agreement among researchers that performance evaluation should include prescriptive programming directed towards improving instructional effectiveness.

Please indicate the number of staff interventions you feel a supervisor should attempt during a calendar year as part of clinical supervision?

5 4 3 2 1 0
In how many of these interventions should success be realized?

5 4 3 2 1 0

Data Collection Source Six: Special Conditions Warranting Consideration as part of the Summative Evaluation

Please indicate if you feel any of the following conditions warrant consideration in preparation of the summative evaluation. If you would include these, weight each according to its rank against the others. Consider 8 as indicative of the most important.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death of a family member</td>
<td></td>
</tr>
<tr>
<td>Birth within the family</td>
<td></td>
</tr>
<tr>
<td>Physical impairment of family member</td>
<td></td>
</tr>
<tr>
<td>Physical impairment of employee</td>
<td></td>
</tr>
<tr>
<td>Emotional disability within family</td>
<td></td>
</tr>
<tr>
<td>Emotional disability of employee</td>
<td></td>
</tr>
<tr>
<td>Awarded &quot;Teacher of the Year&quot;</td>
<td></td>
</tr>
<tr>
<td>Major accomplishment of some kind</td>
<td></td>
</tr>
<tr>
<td>Divorce or marriage</td>
<td></td>
</tr>
</tbody>
</table>

We have examined six potential data collection sources:

(1) teacher performance evaluation criteria
(2) anecdotal notations
(3) student achievement data
(4) performance record
(5) intervention ratings
(6) special conditions
Please indicate other data sources you would include in the completion of a summative evaluation.

______________________________

______________________________

It has been suggested that data be weighted according to their importance within the evaluation process. (Manatt & Stow, 1984) In the algorithm (equation) being designed for this software, how would you weight each of these?

The six items are to be rated between 1 and 5 dependent upon the weight you feel each should exert. Duplication of ratings is permissible. Consider 5 as indicative of maximum weight.

- teacher performance evaluation criteria
- anecdotal notations
- student achievement data
- intervention ratings
- special conditions
- other (please stipulate)
- performance record

Please indicate your name: ________________________________

Would you like to receive a copy of the completed software? ______

Additional Comments:
APPENDIX K: LETTER TO RESEARCHERS
Dear (insert appropriate name),

As part of a doctoral dissertation, I am developing a knowledge-based software program which will assist supervisors in completing the teacher performance evaluation process. Expert systems, or knowledge-based systems attempt to capture the expertise of specialists and encapsulate these data within a software program. In the software I am designing, supervisors will enter performance evaluation data. These data will be placed within an algorithm designed to reflect the pooled expertise of performance evaluation specialists. Using a weighted system of data sources (i.e. teacher performance evaluation criteria, anecdotal notations, student achievement data, performance record, intervention ratings, and special conditions), the program will develop an employee status recommendation of promotion, maintenance, probation or termination.

(insert appropriate name and title) has recommended we contact you as a source for the knowledge base of this software program. A questionnaire has been designed to extract those data needed for program development. If you respond to the enclosed instrument, your responses will be used to frame the configuration of the algorithm.
You will be acknowledged as a contributor to its structure and credited as such. Should you desire, we would be pleased to provide you with a copy of the software at its completion.

It is my hope that this effort, although rudimentary in form, will result in the following; (1) an increased awareness of the impact artificial intelligence can have upon educational processes, and (2) eventually, an increase in the reliability of performance evaluations. Your participation in this project will help assure these outcomes.

Should you have additional questions, please contact me at the number indicated above. Thank you in advance for your assistance.

Sincerely,

Lynn Stevenson
Doctoral Candidate

Dr. Richard Manatt
Major Professor
Performance Evaluation Specialists to be used in Development of Assessment Algorithm

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Michigan State University
East Lansing, MI 48824

Jerry Valentine
University of Missouri
Columbia, Mis 65211

Thomas Good
112 Parkhill
Columbia, Missouri 65201

Ben Harris
University of Texas at Austin
Austin, Texas 78712

Tom McGreal
University of Illinois
Urbana, Ill 61801

Barak Rosenshine
University of Illinois
Urbana, Ill 61801

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APPENDIX L: LETTER TO PERFORMANCE EVALUATION EXPERTS
January 22, 1987

Ed Kelly
Chairman, Department of Educational Leadership
Western Michigan University
Kalamazoo, Michigan 49008

Dear Dr. Kelly,

As part of a doctoral dissertation, I am developing a knowledge-based software program which will assist supervisors in completing the teacher performance evaluation process. Expert systems, or knowledge-based systems, attempt to capture the expertise of specialists and encapsulate these data in a software program. In the software I am designing, supervisors will enter performance evaluation data. These data will be placed within an algorithm designed to reflect the pooled expertise of performance evaluation specialists. Using a weighted system of data sources (i.e. teacher performance evaluation criteria, anecdotal notations, student achievement data, performance record, intervention ratings, and special conditions), the program will develop an employee status recommendation of promotion, maintenance, probation or termination.

Dan Stufflebeam has recommended we contact you as a source for the knowledge base of this software program. A questionnaire has been designed to extract those data needed for program development. If you respond to the enclosed instrument, your responses will be used to frame the configuration of the algorithm.
You will be acknowledged as a contributor to its structure and credited as such. Should you desire, we would be pleased to provide you with a copy of the software at its completion.

It is my hope that this effort, although rudimentary in form, will result in the following; (1) an increased awareness of the impact artificial intelligence can have upon educational processes, and (2) eventually, an increase in the reliability of performance evaluations. Your participation in this project will help assure these outcomes.

Should you have additional questions, please contact me at the number indicated above. Thank you in advance for your assistance.

Sincerely,

Lynn Stevenson
Doctoral Candidate

Dr. Richard Manatt
Major Professor
APPENDIX M: HYPOTHETICAL PERFORMANCE SCENARIOS
Scenario One:

Given the following data, please evaluate this teacher. Indicate the process you used in reaching your conclusions and the manner in which you treated each individual data source.

Teacher Performance Criteria (summative data):

Rating Key: 5=excellent 4=above average 3=standard 2=needs improvement 1=not acceptable

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>The teacher ...</td>
<td></td>
</tr>
<tr>
<td>1. demonstrates effective planning skills</td>
<td>1</td>
</tr>
<tr>
<td>2. implements the lesson plan</td>
<td>1</td>
</tr>
<tr>
<td>3. motivates students</td>
<td>1</td>
</tr>
<tr>
<td>4. communicates effectively with students</td>
<td>2</td>
</tr>
<tr>
<td>5. provides students with specific evaluative feedback</td>
<td>2</td>
</tr>
<tr>
<td>6. prepares appropriate evaluation activities</td>
<td>1</td>
</tr>
<tr>
<td>7. displays a thorough knowledge of curriculum and subject matter</td>
<td>1</td>
</tr>
<tr>
<td>8. selects learning content congruent with the prescribed curriculum</td>
<td>1</td>
</tr>
<tr>
<td>9. provides opportunities for individual differences</td>
<td>1</td>
</tr>
<tr>
<td>10. ensures student time on task</td>
<td>2</td>
</tr>
<tr>
<td>11. sets high expectations for student achievement</td>
<td>1</td>
</tr>
<tr>
<td>12. plans for and makes effective use of time, materials and resources</td>
<td>2</td>
</tr>
<tr>
<td>13. demonstrates evidence of personal organization</td>
<td>1</td>
</tr>
<tr>
<td>14. sets high standards for student behavior</td>
<td>1</td>
</tr>
<tr>
<td>15. organizes students for effective instruction</td>
<td>1</td>
</tr>
<tr>
<td>16. demonstrates effective interpersonal relationships with others</td>
<td>1</td>
</tr>
<tr>
<td>17. demonstrates awareness of the needs of students</td>
<td>1</td>
</tr>
<tr>
<td>18. promotes positive self-concept</td>
<td>2</td>
</tr>
<tr>
<td>19. demonstrates sensitivity in relating to students</td>
<td>1</td>
</tr>
<tr>
<td>20. promotes self-discipline</td>
<td>1</td>
</tr>
</tbody>
</table>

Please comment on the manner in which you will use these data and your evaluation of them.
Interventions:

Over the past seven months, three prescriptive interventions were attempted. None of these interventions resulted in improved performance.

Please comment on the manner in which you would use these data and your evaluation of them.

Ancedotal Notations:

The following data were collected:
* two sets of negative data from other administrators
* one set of negative data from parents
* one set of negative data from students
* one set of negative data from another teacher

Please comment on the manner in which you will use these data and your evaluation of them.
Student Achievement Data:

Norm-referenced test data indicate that only twenty percent of this teacher's students obtained composite scores above the 85th percentile.
Records indicate that only ten percent of this teacher's students have achieved designated instructional objectives.

Please comment on the manner in which you will use these data and your evaluation of them.

Performance Record:

Summative evaluation data (aggregate rating) for this teacher are as follows: Rating Scale: 5=excellent 4=above average 3=standard 2=needs improvement 1=not acceptable

*data which is five years old - teacher rated a 3
*data which is four years old - teacher rated a 3
*data which is two years old - teacher rated a 2
*data which is one year old - teacher rated a 2

Please comment on the manner in which you will use these data and your evaluation of them.
Special Conditions:

During the past year, this employee's mother died. Employee had a child two months ago.

Please comment as to the manner in which you will use these data and your evaluation of them.

Is there additional data you would like to have on this employee in order to complete the summative evaluation? Please list the type of data in which you are interested.

Use your review of these data to rate this employee. Given that each of the following recommendations occur within the numerical range indicated, which status and what numerical designation would you assign?

Promotion
Maintenance
Probation
Termination

Status _______________________

Please indicate a numerical designation or performance score for this teacher.
Scenario Two:

Given the following data, please evaluate this teacher. Indicate the process you used in reaching your conclusions and the manner in which you treated each individual data source.

Teacher Performance Criteria (summative data)

Rating Key: 5=excellent  4=above average  3=standard 2=needs improvement 1=not acceptable

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. demonstrates effective planning skills</td>
<td>5</td>
</tr>
<tr>
<td>2. implements the lesson plan</td>
<td>4</td>
</tr>
<tr>
<td>3. motivates students</td>
<td>5</td>
</tr>
<tr>
<td>4. communicates effectively with students</td>
<td>5</td>
</tr>
<tr>
<td>5. provides students with specific evaluative feedback</td>
<td>4</td>
</tr>
<tr>
<td>6. prepares appropriate evaluation activities</td>
<td>4</td>
</tr>
<tr>
<td>7. displays a thorough knowledge of curriculum and subject matter</td>
<td>5</td>
</tr>
<tr>
<td>8. selects learning content congruent with the prescribed curriculum</td>
<td>5</td>
</tr>
<tr>
<td>9. provides opportunities for individual differences</td>
<td>4</td>
</tr>
<tr>
<td>10. ensures student time on task</td>
<td>5</td>
</tr>
<tr>
<td>11. sets high expectations for student achievement</td>
<td>5</td>
</tr>
<tr>
<td>12. plans for and makes effective use of time, materials and resources</td>
<td>4</td>
</tr>
<tr>
<td>13. demonstrates evidence of personal organization</td>
<td>5</td>
</tr>
<tr>
<td>14. sets high standards for student behavior</td>
<td>5</td>
</tr>
<tr>
<td>15. organizes students for effective instruction</td>
<td>4</td>
</tr>
<tr>
<td>16. demonstrates effective interpersonal relationships with others</td>
<td>5</td>
</tr>
<tr>
<td>17. demonstrates awareness of the needs of students</td>
<td>5</td>
</tr>
<tr>
<td>18. promotes positive self-concept</td>
<td>5</td>
</tr>
<tr>
<td>19. demonstrates sensitivity in relating to students</td>
<td>5</td>
</tr>
<tr>
<td>20. promotes self-discipline</td>
<td>5</td>
</tr>
</tbody>
</table>

Please comment on the manner in which you will use these data and your evaluation of them.
Interventions:

Over the past seven months, three prescriptive interventions were attempted. All of these interventions resulted in improved performance. (positive outcomes)

Please comment on the manner in which you would use these data and your evaluation of them.

Ancedotal Notations:

The following data were collected:
* two sets of positive data from other administrators
* one set of positive data from parents
* one set of positive data from students
* one set of positive data from another teacher

Please comment on the manner in which you will use these data and your evaluation of them.
Student Achievement Data:

Norm-referenced test data indicate that 90 percent of this teacher's students obtained composite scores above the 85th percentile.

Records indicate that 95 percent of this teacher's students have achieved designated instructional objectives.

Please comment on the manner in which you will use these data and your evaluation of them.

Performance Record:

Summative evaluation data (aggregate rating) for this teacher is as follows: Rating Scale: 5=excellent, 4=above average, 3=standard, 2=needs improvement, 1=not acceptable

*data which is five years old - teacher rated a 4
*data which is four years old - teacher rated a 5
*data which is three years old - teacher rated a 5
*data which is two years old - teacher rated a 5
*data which is one year old - teacher rated a 5

Please comment on the manner in which you will use these data and your evaluation of them.
Special Conditions:

During the past year, this teacher was elected president of the district's teacher's union and received media recognition as teacher of the year.

Please comment as to the manner in which you will use these data and your evaluation of them.

Is there additional data you would like to have on this employee for the purpose of completing a summative evaluation? Please list the type of data in which you are interested.

Use your review of these data to rate this employee. Given that each of the following recommendations occur within the numerical range indicated, which status and what numerical designation would you assign?

Promotion
Maintenance
Probation
Termination

Status

Please indicate a numerical designation or performance score for this teacher.
Scenario Three:

Given the following data, please evaluate this teacher. Indicate the process you used in reaching your conclusions and the manner in which you treated each individual data source.

Teacher Performance Criteria (summative data)

Rating Key: 5=excellent  4=above average  3=standard  2=needs improvement  1=not acceptable

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. demonstrates effective planning skills</td>
<td>4</td>
</tr>
<tr>
<td>2. implements the lesson plan</td>
<td>3</td>
</tr>
<tr>
<td>3. motivates students</td>
<td>3</td>
</tr>
<tr>
<td>4. communicates effectively with students</td>
<td>4</td>
</tr>
<tr>
<td>5. provides students with specific evaluative feedback</td>
<td>3</td>
</tr>
<tr>
<td>6. prepares appropriate evaluation activities</td>
<td>3</td>
</tr>
<tr>
<td>7. displays a thorough knowledge of curriculum and subject matter</td>
<td>3</td>
</tr>
<tr>
<td>8. selects learning content congruent with the prescribed curriculum</td>
<td>4</td>
</tr>
<tr>
<td>9. provides opportunities for individual differences</td>
<td>3</td>
</tr>
<tr>
<td>10. ensures student time on task</td>
<td>3</td>
</tr>
<tr>
<td>11. sets high expectations for student achievement</td>
<td>3</td>
</tr>
<tr>
<td>12. plans for and makes effective use of time, materials and resources</td>
<td>3</td>
</tr>
<tr>
<td>13. demonstrates evidence of personal organization</td>
<td>3</td>
</tr>
<tr>
<td>14. sets high standards for student behavior</td>
<td>3</td>
</tr>
<tr>
<td>15. organizes students for effective instruction</td>
<td>3</td>
</tr>
<tr>
<td>16. demonstrates effective interpersonal relationships with others</td>
<td>3</td>
</tr>
<tr>
<td>17. demonstrates awareness of the needs of students</td>
<td>3</td>
</tr>
<tr>
<td>18. promotes positive self-concept</td>
<td>4</td>
</tr>
<tr>
<td>19. demonstrates sensitivity in relating to students</td>
<td>3</td>
</tr>
<tr>
<td>20. promotes self-discipline</td>
<td>3</td>
</tr>
</tbody>
</table>

Please comment on the manner in which you will use these data and your evaluation of them.
Interventions:

Over the past seven months, three prescriptive interventions were attempted. One of these interventions resulted in improved performance.

Please comment on the manner in which you would use these data and your evaluation of them.

Anecdotal Notations:

The following data were collected:
* two sets of data from other administrators— one set was positive in content, the other was negative
* one set of data from parents— positive in content
* one set of data from students— positive in content
* one set of data from other teachers— negative in content

Please comment on the manner in which you will use these data and your evaluation of them.
Student Achievement Data:

Norm-referenced test data indicate that 50 percent of this teacher's students obtained composite scores above the 85th percentile.

Records indicate that 50 percent of this teacher's students have achieved designated instructional objectives.

Please comment on the manner in which you will use these data and your evaluation of them.

Performance Record:

Summative evaluation data (aggregate rating) for this teacher is as follows: Rating scale: 5=excellent 4=above average 3=standard 2=needs improvement 1=not acceptable

*data which is five years old - teacher rated a 3
*data which is four years old - teacher rated a 3
*data which is three years old - teacher rated a 3
*data which is two years old - teacher rated a 3
*data which is one year old - teacher rated a 3

Please comment on the manner in which you will use these data and your evaluation of them.
Special Conditions:

No special conditions were noted for this employee.

Please comment as to the manner in which you will use these data and your evaluation of them.

Is there additional data you would like to have on this employee in order to complete the summative evaluation? Please list the type of data in which you are interested.

Use your review of these data to rate this employee. Given that each of the following recommendations occur within the numerical range indicated, which status and what numerical designation would you assign?

Promotion
Maintenance
Probation
Termination

Status

Please indicate a numerical designation or performance score for this teacher.
Scenario Four:

Given the following data, please evaluate this teacher. Indicate the process you used in reaching your conclusions and the manner in which you treated each individual data source.

Teacher Performance Criteria:

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. demonstrates effective planning skills</td>
<td>4</td>
</tr>
<tr>
<td>2. implements the lesson plan</td>
<td>2</td>
</tr>
<tr>
<td>3. motivates the students</td>
<td>3</td>
</tr>
<tr>
<td>4. communicates effectively with students</td>
<td>2</td>
</tr>
<tr>
<td>5. provides students with specific evaluative feedback</td>
<td>5</td>
</tr>
<tr>
<td>6. prepares appropriate evaluation activities</td>
<td>3</td>
</tr>
<tr>
<td>7. displays a thorough knowledge of curriculum and subject matter</td>
<td>4</td>
</tr>
<tr>
<td>8. selects learning content congruent with the prescribed curriculum</td>
<td>2</td>
</tr>
<tr>
<td>9. provides opportunities for individual differences</td>
<td>3</td>
</tr>
<tr>
<td>10. ensures student time on task</td>
<td>5</td>
</tr>
<tr>
<td>11. sets high expectations for student achievement</td>
<td>4</td>
</tr>
<tr>
<td>12. plans for and makes effective use of time, materials and resources</td>
<td>3</td>
</tr>
<tr>
<td>13. demonstrates evidence of personal organization</td>
<td>2</td>
</tr>
<tr>
<td>14. sets high standards for student behavior</td>
<td>1</td>
</tr>
<tr>
<td>15. organizes students for effective instruction</td>
<td>3</td>
</tr>
<tr>
<td>16. demonstrates effective interpersonal relationships with others</td>
<td>2</td>
</tr>
<tr>
<td>17. demonstrates awareness of the needs of students</td>
<td>4</td>
</tr>
<tr>
<td>18. promotes positive self-concept</td>
<td>3</td>
</tr>
<tr>
<td>19. demonstrates sensitivity in relating to students</td>
<td>2</td>
</tr>
<tr>
<td>20. promotes self-discipline</td>
<td>5</td>
</tr>
</tbody>
</table>

Please comment on the manner in which you will use these data and your evaluation of them.
Interventions:

Over the past seven months, three prescriptive interventions were attempted. One of these resulted in improved performance.

Please comment on the manner in which you would use these data and your evaluation of them.

Anecdotal Notations:

The following data were collected:

* Two sets of data from other administrators—both sets were negative
* One set of data from parents—positive in content
* One set of data from students—positive in content
* One set of data from other teachers—negative in content

Please comment on the manner in which you will use these data and your evaluation of them.
Student Achievement Data:

Norm-referenced test data indicate that 40 percent of this teacher's students obtained composite scores above the 85th percentile.

Records indicate that 55 percent of this teacher's students have achieved designated instructional objectives.

Please comment on the manner in which you will use these data and your evaluation of them.

Performance Record:

Summative evaluation data (aggregate rating) for this teacher is as follows: Rating scale: 5=excellent 4=above average 3=standard 2=needs improvement 1=not acceptable

*data which is five years old - teacher rated a 4
*data which is four years old - teacher rated a 5
*data which is three years old - teacher rated a 3
*data which is two years old - teacher rated a 2
*data which is one year old - teacher rated a 1

Please comment on the manner in which you will use these data and your evaluation of them.
Special Conditions:

During the past year this teacher was arrested for possession of illicit drugs and experienced an emotional breakdown. It was revealed that this employee is a homosexual.

Please comment as to the manner in which you will use these data and your evaluation of them.

Is there additional data you would like to have on this employee in order to complete the summative evaluation? Please list the type of data in which you are interested.

Use your review of these data to rate this employee. Given that each of the following recommendations occur within the numerical range indicated, which status and what numerical designation would you assign?

Promotion
Maintenance
Probation
Termination

Status

Please indicate a numerical designation or performance score for this teacher.
Scenario Five:

Given the following data, please evaluate this teacher. Indicate the process you used in reaching your conclusions and the manner in which you treated each individual data source.

Teacher Performance Criteria:

Rating Key: 5=excellent 4=above average 3=standard 2=needs improvement 1=not acceptable

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. demonstrates effective planning skills</td>
<td>3</td>
</tr>
<tr>
<td>2. implements the lesson plan</td>
<td>4</td>
</tr>
<tr>
<td>3. motivates the students</td>
<td>2</td>
</tr>
<tr>
<td>4. communicates effectively with students</td>
<td>5</td>
</tr>
<tr>
<td>5. provides students with specific evaluative feedback</td>
<td>2</td>
</tr>
<tr>
<td>6. prepares appropriate evaluation activities</td>
<td>3</td>
</tr>
<tr>
<td>7. displays a thorough knowledge of curriculum and subject matter</td>
<td>1</td>
</tr>
<tr>
<td>8. selects learning content congruent with the prescribed curriculum</td>
<td>4</td>
</tr>
<tr>
<td>9. provides opportunities for individual differences</td>
<td>2</td>
</tr>
<tr>
<td>10. ensures student time on task</td>
<td>3</td>
</tr>
<tr>
<td>11. sets high expectations for student achievement</td>
<td>4</td>
</tr>
<tr>
<td>12. plans for and makes effective use of time, materials and resources</td>
<td>2</td>
</tr>
<tr>
<td>13. demonstrates evidence of personal organization</td>
<td>1</td>
</tr>
<tr>
<td>14. sets high standards for student behavior</td>
<td>4</td>
</tr>
<tr>
<td>15. organizes students for effective instruction</td>
<td>3</td>
</tr>
<tr>
<td>16. demonstrates effective interpersonal relationships with others</td>
<td>5</td>
</tr>
<tr>
<td>17. demonstrates awareness of the needs of students</td>
<td>2</td>
</tr>
<tr>
<td>18. promotes positive self-concept</td>
<td>3</td>
</tr>
<tr>
<td>19. demonstrates sensitivity in relating to students</td>
<td>1</td>
</tr>
<tr>
<td>20. promotes self-discipline</td>
<td>4</td>
</tr>
</tbody>
</table>

Please comment on the manner in which you will use these data and your evaluation of them.
Interventions:

Over the past seven months, three prescriptive interventions were attempted. Three of these resulted in improved performance.

Please comment on the manner in which you would use these data and your evaluation of them.

Anecdotal Notations:

The following data were collected:

* two sets of data from other administrators—both sets contained positive information
* one set of data from parents—negative in content
* one set of data from students—negative in content
* one set of data from other teachers—positive in content

Please comment on the manner in which you will use these data and your evaluation of them.
Student Achievement Data:

Norm-referenced test data indicate that 65 percent of this teacher's students obtained composite scores above the 85th percentile.

Records indicate that 35 percent of this teacher's students have achieved designated instructional objectives.

Please comment on the manner in which you will use these data and your evaluation of them.

Performance Record:

Summative evaluation data (aggregate rating) for this teacher is as follows: Rating scale: 5=excellent  4=above average  3=standard 2=needs improvement  1=not acceptable

*data which is five years old - teacher rated a 1
*data which is four years old - teacher rated a 2
*data which is three years old - teacher rated a 3
*data which is two years old - teacher rated a 4
*data which is one year old - teacher rated a 5

Please comment on the manner in which you will use these data and your evaluation of them.
Special Conditions:

During the past year, this teacher's father died and her daughter was hospitalized.

Please comment as to the manner in which you will use these data and your evaluation of them.

Is there additional data you would like to have on this employee in order to complete the summative evaluation? Please list the type of data in which you are interested.

Use your review of these data to rate this employee. Given that each of the following recommendations occur within the numerical range indicated, which status and what numerical designation would you assign?

Promotion
Maintenance
Probation
Termination

Status __________________

Please indicate a numerical designation or performance score for this teacher.
APPENDIX N: LETTER TO PERFORMANCE EVALUATORS
INSTRUCTIONS FOR COMPLETION OF SCENARIOS ONE TO FIVE

DATA REPRESENTATION:

The five scenarios included in this packet have been developed to include data specific to the design of an assessment algorithm. Each scenario represents hypothetical data collected on a teacher during one calendar year. Numerical ratings within the teacher performance evaluation criteria should be treated as summative.

RESPONSE STRUCTURE:

After reading data from the first source (teacher performance evaluation criteria), please indicate:

(1) How you would use these data
(2) Your immediate reaction to them

At the completion of this section, please proceed to the other five data sources and respond in the same manner placing comments in the space provided beneath each data summary. Comments should be brief. If you find, after completing the first scenario, that your comments are going to be identical throughout the assessment exercise, please record comments only on the first scenario.

Please respond to the question asking about additional data to which you might like to have access.

The most important section of the evaluation is your estimation of the teacher's employment status. After careful consideration of the data, please assign this teacher to one of the four status options. Note the numerical designation which you feel best represents this teacher's performance. Assume that we are working within a numerical continuum which begins at zero with correspondent status assignment of termination and incrementally progresses to 100 with a correspondent status of promotion.
APPENDIX 0: K-EAS PAPERWARE
KNOWLEDGE-BASED ASSESSMENT SYSTEM

(K-BAS)

Computer Software Program Designed for use with Teacher Performance Evaluation Data

Lynn Stevenson, Author
Dr. Richard P. Manatt, Major Professor

This program completed as a part of a doctoral dissertation. May, 1987

Unpublished Work © 1987
K-BAS has been designed to provide assistance in teacher performance evaluation. It represents a departure from software programs currently available in that it is structured to seek data and propose options for interpretation of these data. Knowledge-based or expert systems are one component of artificial intelligence. Expert systems use heuristics or rule-of-thumb evaluation to narrow the search for possible solutions to a given problem. Expert systems most effectively assist in the resolution of problems requiring significant human expertise.

Teacher performance evaluation is a complex process requiring a high level of skills. It was therefore determined a viable problem for the application of expert systems technology. This software program was designed in an attempt to test the feasibility of using a knowledge-based system in teacher performance evaluation.

An examination of research related to teacher performance revealed the need for definition of data collection sources, informational resources used in formation of the summative evaluation. A pool of potential data sources was submitted to a jury of performance evaluation experts for validation. The same group of experts were asked to weight each of the selected sources defining its impact in performance evaluation. These weighted data were placed in an algorithm which became the knowledge base for the design of K-BAS.
K-BAS requests supervisors to input performance evaluation data. These data are processed by the algorithm as it develops a performance score. Each performance score produces a corresponding effectiveness classification of termination, probation, maintenance, or promotion.

Developed as a result of theoretical research, specific caveats apply to K-BAS. Effectiveness classifications or status recommendations are to be used as would data from another appraiser -- as part of a collection of archival documentation. Attaching an inordinate amount of weight to a judgement produced by the system is inappropriate and violates the parameters established during system design.

**Key Concepts and Terms**

Data Collection Source: A source of data identified in teacher performance evaluation research as meriting consideration in formation of the summative evaluation. K-BAS uses six data collection sources.

Teacher Performance Criteria: Indices of instructional effectiveness. K-BAS uses twenty teacher performance criteria. These criteria were identified through research undertaken by the School Improvement Models Project, Iowa State University.

Anecdotal Notations: Recorded accounts of data significant to the assessment process. K-BAS requests the entry of five data sources. Data providers include: administrators, parents, teachers, student, and others.

Intervention Ratings: The outcome of assistance offered to the teacher as a result of one of several clinical techniques, e.g., written plans for improvement, conferences, classroom strategies. K-BAS requests the entry of three pieces of data. Obviously, data should be from the most recently completed interventions.

Achievement Data: Norm or criterion referenced statistical analysis depicting the degree to which students have mastered stated objectives. K-BAS uses norm or criterion referenced data.

Special Conditions Data: Positive or negative circumstances which could effect teacher performance. K-BAS allows the supervisor to take into consideration such catastrophic events as death, divorce, and illness as well as award for positive recognitions.
Performance Record Data: Longitudinal data depicting previous teacher performance. K-BAS allows for the entry of three years of archival records.

Aggregate Sum: Elements in each data collection source are weighted and summed. This group of scores is called the aggregate sum. Each data collection source has an aggregate sum.

Total Algorithm: Each aggregate sum is weighted. The sum of all the weighted aggregate sums is called the total algorithm.

Status Recommendation: The option presented to the user after calculation of the total algorithm. Four options are considered by K-BAS — promotion, maintenance, probation or termination. Also referenced as the effectiveness classification.

Performance Score: The score resulting from manipulation of weighted data collection sources in the total algorithm.

Data Entry Procedures

K-BAS is user-friendly. Commands are provided at the end of comment sections directing the user to the expected response. After a response has been chosen, the "enter" key must be used. This informs the program that a command is to be executed.

The program is menu-driven. This allows the user to return to any section of the program by entering the numerical designator for that option. The user can choose from eight menu items; (1) performance criteria, (2) anecdotal notations, (3) intervention ratings, (4) achievement data, (5) special conditions data, (6) performance record data, (7) total algorithm representation, and (8) program termination.

K-BAS opens with the display in Screen One.
WELCOME TO K-BAS

KNOWLEDGE-BASED ASSESSMENT SYSTEM

(FOR USE WITH TEACHER PERFORMANCE EVALUATION DATA)

THIS KNOWLEDGE-BASED SYSTEM HAS BEEN DEVELOPED TO ASSIST YOU IN COMPLETING THE PERFORMANCE EVALUATION PROCESS. YOU WILL BE ASKED TO ENTER SIX TYPES OF DATA, ALL PREVIOUSLY COLLECTED DURING THE ASSESSMENT CYCLE. THESE DATA WILL BE ANALYZED WITHIN AN ALGORITHM AND A STATUS RECOMMENDATION OF: (1) PROMOTION; (2) MAINTENANCE; (3) PROBATION; OR (4) TERMINATION WILL BE DEVELOPED. THE ALGORITHM HAS BEEN STRUCTURED TO CAPTURE THE EXPERTISE OF PERFORMANCE EVALUATION SPECIALISTS AND USE THIS INFORMATION AS IT PROCESSES DATA YOU HAVE ENTERED.

PLEASE REFERENCE THE PAPERWARE ACCOMPANYING THIS PROGRAM FOR ADDITIONAL INFORMATION ON PROGRAM RATIONALE AND DATA ENTRY PROCEDURES.

PRESS 'ENTER' WHEN YOU ARE READY TO CONTINUE:

Screen two provides the user with additional instructions for program use.

K-BAS REQUESTS YOUR RESPONSE TO A SERIES OF QUESTIONS. PLEASE READ INSTRUCTIONS CAREFULLY AND ENTER DATA ACCURATELY. THE PROGRAM PROVIDES OPPORTUNITIES WITHIN EACH DATA ENTRY SECTION FOR REENTRY OF INCORRECTLY SUBMITTED INFORMATION.

K-BAS IS MENU-DRIVEN, OFFERING EIGHT OPTIONS FOR YOUR CONSIDERATION. TO BEGIN THE ANALYSIS, YOU WILL NEED TO PRESS THE 'ENTER' KEY, SELECT THE DATA COLLECTION SOURCE YOU DESIRE, AND ENTER THE APPROPRIATE CODE FOR THAT OPTION.

PRESS 'ENTER' WHEN YOU ARE READY TO BEGIN:
As indicated in Screen Two, K-BAS allows the user easy access to each of the data collection sources through a central menu. At the completion of each data entry section, the user is returned to the menu for the next selection. The menu also includes a data entry check; this affords the user the opportunity to verify completion of a specific data entry section.

Data held in the data entry sections are not protected. The user can exercise the option of reentry at any point in the program. Data are held only until new data overwrites them. This structure allows the user maximum flexibility in data entry and correction.

Screen Three presents the options contained on the central program menu.

SCREEN THREE

OPTION MENU FOR ALGORITHM DATA SOURCE

SELECT THE OPTION YOU NEED AND ENTER THE ACCESS CODE

<table>
<thead>
<tr>
<th>CODE</th>
<th>OPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PERFORMANCE CRITERIA</td>
</tr>
<tr>
<td>2</td>
<td>ANECDOTAL NOTATIONS</td>
</tr>
<tr>
<td>3</td>
<td>INTERVENTION RATINGS</td>
</tr>
<tr>
<td>4</td>
<td>ACHIEVEMENT DATA</td>
</tr>
<tr>
<td>5</td>
<td>SPECIAL CONDITIONS DATA</td>
</tr>
<tr>
<td>6</td>
<td>PERFORMANCE RECORD DATA</td>
</tr>
<tr>
<td>7</td>
<td>TOTAL ALGORITHM REPRESENTATION</td>
</tr>
<tr>
<td>8</td>
<td>PROGRAM TERMINATION</td>
</tr>
</tbody>
</table>

YOU HAVE COMPLETED THE FOLLOWING DATA SECTIONS:
PERF.EVAL.  ANC.NOT
INTR.DATA   ACH.DATA
SPEC.COND.  PERF.REC.

ENTER THE DESIRED OPTION (1 TO 8):

------------------------------
DATA COLLECTION SOURCE ONE: TEACHER PERFORMANCE CRITERIA

Upon entry into any of the six data collection sources, the user is presented with introductory text explaining key components in that section. Instructions related to data entry procedures are also provided. Upon selection of option one, Teacher Performance Criteria, the user will receive the message on Screen four:

SCREEN FOUR

K-BAS uses data collected from the Teacher Performance Evaluation Instrument developed at Iowa State University. Prior to data entry for this section, you should have the following materials: (1) A completed summative evaluation for each of the twenty criteria, enter the appropriate rating (one to five) and press 'enter'.

Press 'return' when you are ready for data entry:

K-BAS has been designed to use the Teacher Performance Evaluation Criteria developed at Iowa State University. This instrument uses 24 criteria to evaluate teacher effectiveness. K-BAS uses the first 20 of these criteria in its algorithm.

When preparing to enter data into this section, the user will need to have summative ratings between one and five for each of the twenty criteria on the Teacher Performance Evaluation instrument. K-BAS will provide a prompt requesting a rating for each criteria. The user will need to key in the appropriate rating and press the
"enter" key. Each of the succeeding criteria will be displayed in the same manner. Screen Five displays this section.

SCREEN FIVE

******************************************************************************

**********TEACHER PERFORMANCE CRITERIA DATA ENTRY SECTION**********

ENTER A RATING BETWEEN ONE AND FIVE:

CRITERION 1: DEMONSTRATES EFFECTIVE PLANNING SKILLS:
CRITERION 2: IMPLEMENTS THE LESSON PLAN:
CRITERION 3: MOTIVATES STUDENTS:
CRITERION 4: COMMUNICATES EFFECTIVELY WITH STUDENTS:
CRITERION 5: PROVIDES STUDENTS WITH EVALUATIVE FEEDBACK:
CRITERION 6: PREPARES APPROPRIATE EVALUATION ACTIVITIES:
CRITERION 7: DISPLAYS KNOWLEDGE OF CURRICULUM & SUBJECT MATTER:
CRITERION 8: LEARNING CONTENT CONGRUENT WITH CURRICULUM:
CRITERION 9: OPPORTUNITIES FOR INDIVIDUAL DIFFERENCES:
CRITERION 10: ENSURES STUDENT TIME ON TASK:
CRITERION 11: SETS HIGH EXPECTATIONS FOR STUDENT ACHIEVEMENT:
CRITERION 12: EFFECTIVE USE OF TIME, MATERIALS, RESOURCES:
CRITERION 13: DEMONSTRATES EVIDENCE OF PERSONAL ORGANIZATION:
CRITERION 14: SETS HIGH STANDARDS FOR STUDENT BEHAVIOR:
CRITERION 15: ORGANIZES STUDENTS FOR EFFECTIVE INSTRUCTION:
CRITERION 16: EFFECTIVE INTERPERSONAL RELATIONSHIPS:
CRITERION 17: DEMONSTRATES AWARENESS OF NEEDS OF STUDENTS:
CRITERION 18: PROMOTES POSITIVE SELF-CONCEPT:
CRITERION 19: SENSITIVITY IN RELATING TO STUDENTS:
CRITERION 20: PROMOTES SELF-DISCIPLINE AND RESPONSIBILITY:

After all data have been entered, K-BAS will display the twenty criteria for the review of the user. If inaccuracies are detected, the user has the option of reentering the data. If data have been properly recorded, the program continues by processing the data into the aggregate sum and presenting this to the user. The user is then returned to the main menu. Screen six displays the verification structure.
YOU HAVE ENTERED THE FOLLOWING DATA:

CRITERION 1: CRITERION 11:
CRITERION 2: CRITERION 12:
CRITERION 3: CRITERION 13:
CRITERION 4: CRITERION 14:
CRITERION 5: CRITERION 15:
CRITERION 6: CRITERION 16:
CRITERION 7: CRITERION 17:
CRITERION 8: CRITERION 18:
CRITERION 9: CRITERION 19:
CRITERION 10: CRITERION 20:

ENTER '1' IF YOU NEED TO REENTER DATA
PRESS 'RETURN' IF YOU WISH TO PROCEED
INDICATE YOUR CHOICE HERE:

The user is then presented with the aggregate sum for data entered and redirected to the menu. Screen seven displays aggregate sum data.

THE INDIVIDUAL AGGREGATE SUM FOR THESE DATA EQUALS:
THIS SUM WILL BE WEIGHTED AND PLACED IN THE ASSESSMENT ALGORITHM.

WHEN YOU ARE READY TO CONTINUE, PRESS 'ENTER':

DATA COLLECTION SOURCE TWO: ANECDOTAL NOTATIONS

Option two on the main menu, this section of the program begins
with explanatory text. Users are informed that five pieces of data will be requested. For each piece of datum, the provider and the status (positive or negative) must be available for input. Screen eight displays this message.

SCREEN EIGHT

********************DATA COLLECTION SOURCE TWO*************************
********************ANECDOTAL NOTATIONS*****************************

ANECDOTAL NOTATIONS ARE DERIVED FROM MANY SOURCES. K-BAS HAS ASSIGNED A WEIGHT TO EACH POTENTIAL DATA SOURCE. WHEN YOU ENTER YOUR DATA IT WILL BE NECESSARY FOR YOU TO INDICATE TO THE SYSTEM THE APPROPRIATE WEIGHT OF THE DATA YOU ARE ENTERING. OBVIOUSLY, THE STATUS OF YOUR DATA MUST ALSO BE CONSIDERED IN THE DECISION-MAKING PROCESS. YOU WILL NEED TO INDICATE TO THE SYSTEM THE APPROPRIATE STATUS FOR YOUR DATA.

PRIOR TO DATA ENTRY FOR THIS SECTION, YOU SHOULD HAVE THE FOLLOWING MATERIALS: (1) FIVE SOURCES OF DATA; (2) THE APPROPRIATE WEIGHT AND STATUS FOR ALL ENTRIES.

PRESS 'ENTER' WHEN YOU ARE READY TO BEGIN:

The user is then presented with information needed for data entry. Screen nine displays this information.
SCREEN NINE

DATA ENTRY SECTION ANECDOTAL NOTATIONS

THESE WEIGHTINGS HAVE BEEN DETERMINED FOR THE FOLLOWING DATA PROVIDERS:

ADMINISTRATOR: ENTER 2.75
PARENT : ENTER 2.38
STUDENT : ENTER 3.75
TEACHER : ENTER 2.71
OTHER : ENTER 3.60

ENTER THE APPROPRIATE WEIGHT FOR YOUR DATA:

The status of the user’s data is requested in Screen Ten.

SCREEN TEN

DATA ENTRY SECTION ANECDOTAL NOTATIONS

THESE WEIGHTINGS HAVE BEEN DETERMINED AS INDICATIVE OF DATA STATUS:

POSITIVE DATA: ENTER 2
NEGATIVE DATA: ENTER 1

ENTER THE APPROPRIATE STATUS FOR YOUR DATA:

The user is prompted to enter five pieces of data in the same manner. After all data for this source have been entered, the system uses a verification loop to allow for reentry of data. Screen eleven illustrates this design feature.
SCREEN ELEVEN

YOU HAVE ENTERED THE FOLLOWING DATA:

<table>
<thead>
<tr>
<th>DATA</th>
<th>WEIGHT</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOURCE ONE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOURCE TWO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOURCE THREE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOURCE FOUR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOURCE FIVE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ENTER 1 IF YOU NEED TO REENTER DATA.
PRESS 'ENTER' IF YOU WISH TO PROCEED.
INDICATE YOUR CHOICE HERE:

If the user decides to reenter data, the program loops back to the start of the entry sequence. After all data have been satisfactorily entered, the user is presented with the aggregate score for this data collection source and redirected to the menu. Screen twelve presents aggregate sum data.

SCREEN TWELVE

THE AGGREGATE SUM FOR THESE DATA EQUALS:
THIS SUM WILL BE WEIGHTED AND PLACED IN THE ASSESSMENT ALGORITHM.

WHEN YOU ARE READY TO CONTINUE, PRESS 'ENTER':
DATA COLLECTION SOURCE THREE: INTERVENTION RATINGS

Explanatory text is provided at the start of intervention ratings, the third option on the main menu. The user must have evidence from three interventions made during the evaluation period as can be seen in Screen Thirteen.

SCREEN THIRTEEN

K-BAS USES PRESCRIPTIVE INTERVENTION DATA IN THE FORMATION OF ITS STATUS ALGORITHM. YOU WILL NEED TO ENTER THREE PIECES OF DATA AND INDICATE THE STATUS OF EACH — WERE ANTICIPATED OUTCOMES REALIZED AS A RESULT OF THE INTERVENTION?

PRIOR TO DATA ENTRY FOR THIS SECTION, YOU SHOULD HAVE THE FOLLOWING MATERIALS: (1) THREE PIECES OF DATA; (2) A STATUS ASSIGNMENT OF POSITIVE OR NEGATIVE FOR EACH PIECE OF DATA.

PRESS 'ENTER' WHEN YOU ARE READY TO BEGIN:

At the onset of each data collection source, the user is provided with a list of materials needed for data entry. This section requires the user to enter three pieces of data and indicate a status of positive or negative for each. A positive status assignment indicating that expected outcomes were realized; a negative status assignment indicating that desired outcomes did not occur. Screen fourteen displays the data entry section for this source.
DATA ENTRY SECTION

AS INDICATED ABOVE, YOU WILL NEED TO ENTER THREE SOURCES OF DATA TO ALLOW THE ALGORITHM TO FUNCTION. YOU WILL ALSO NEED TO ENTER THE STATUS OF EACH INTERVENTION -- WAS IT POSITIVE OR NEGATIVE?

THESE WEIGHTS HAVE BEEN DETERMINED AS INDICATIVE OF DATA STATUS:

POSITIVE DATA: ENTER 2
NEGATIVE DATA: ENTER 1

ENTER THE APPROPRIATE STATUS FOR DATA SOURCE ONE:

After all data have been entered, K-BAS displays recorded data for the review of the user. If corrections need to be made, the user has the option of returning to the onset of the data entry section. Screen fifteen displays this section.

YOU HAVE ENTERED THE FOLLOWING DATA:

<table>
<thead>
<tr>
<th>DATA</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOURCE ONE</td>
<td>2</td>
</tr>
<tr>
<td>SOURCE TWO</td>
<td>2</td>
</tr>
<tr>
<td>SOURCE THREE</td>
<td>2</td>
</tr>
</tbody>
</table>

ENTER 1 IF YOU NEED TO REENTER DATA.
PRESS 'ENTER' IF YOU WISH TO PROCEED.
INDICATE YOUR CHOICE HERE:
Provided all data are accurately recorded, the program continues to process these data and develops an aggregate sum for presentation to the user. The program then redirects the user to the main menu. Screen sixteen displays aggregate sum data.

SCREEN SIXTEEN

THE AGGREGATE SUM FOR THESE DATA EQUALS:
THIS SUM WILL BE WEIGHTED AND PLACED IN THE ASSESSMENT ALGORITHM.

WHEN YOU ARE READY TO CONTINUE, PRESS 'ENTER':

DATA COLLECTION SOURCE FOUR: ACHIEVEMENT DATA

The fourth option on the Data Source Menu is Achievement Data. The user would be presented with the introductory comments displayed in Screen seventeen.

SCREEN SEVENTEEN

****************DATA COLLECTION SOURCE FOUR*************************
K-BAS HAS BEEN WRITTEN TO ACCEPT STANDARDIZED NORM-REFERENCED ACHIEVEMENT DATA AND CRITERION-REFERENCED TEST DATA. WHEN NORM-REFERENCED TEST DATA IS USED, THE FOLLOWING CRITERIA APPLY: (1) THE CUMULATIVE SCORE WHICH BEST REPRESENTS THE TEACHER'S IMPACT UPON STUDENT ACHIEVEMENT SHOULD BE USED, AND (2) NATIONAL NORMS SHOULD BE REFERENCED.

WHEN CRITERION-REFERENCED TEST DATA IS USED, THE FOLLOWING GUIDELINE APPLIES: (1) CUMULATIVE STUDENT SCORES REPRESENTING OVERALL STUDENT PERFORMANCE SHOULD BE USED.

IN EITHER CASE, YOU SHOULD SELECT FROM THE RANKINGS LIST THE APPROPRIATE CATEGORY FOR YOUR DATA AND ENTER THAT RANK AT THE PROMPT.

PRESS 'ENTER' WHEN YOU ARE READY TO BEGIN:
The user must determine which type of data is to be used — criterion or norm-referenced. After this decision is made, appropriate data must be collected and percentage scores compiled. Screen eighteen displays the information provided to the user.

SCREEN EIGHTEEN

******************************************************************DATA ENTRY SECTION ACHIEVEMENT DATA******************************************************************

THESE RANKS HAVE BEEN DETERMINED FOR THE FOLLOWING STUDENT ACHIEVEMENT DATA:

63% OF STUDENTS SCORE ABOVE THE 85TH PERCENTILE: ENTER 5
50% OF STUDENTS SCORE ABOVE THE 85TH PERCENTILE: ENTER 4
38% OF STUDENTS SCORE ABOVE THE 85TH PERCENTILE: ENTER 3
26% OF STUDENTS SCORE ABOVE THE 85TH PERCENTILE: ENTER 2
17% OF STUDENTS SCORE ABOVE THE 85TH PERCENTILE: ENTER 1

ENTER THE APPROPRIATE RANK FOR YOUR DATA:

A verification loop is available for the convenience of data reentry. Screen nineteen presents this structure.

SCREEN NINETEEN

YOU HAVE ENTERED THE FOLLOWING RANK:

ENTER '1' IF YOU WISH TO REENTER YOUR DATA. PRESS 'RETURN' IF YOU WISH TO PROCEED. INDICATE YOUR CHOICE HERE:

After inputing the appropriate rank for the data used, the user
is presented with its weight and redirected to the menu.

Screen twenty displays this datum.

SCREEN TWENTY

THE NUMERICAL RANK FOR THESE DATA EQUALS:

THIS RANK WILL BE WEIGHTED AND PLACED IN THE ASSESSMENT ALGORITHM.

WHEN YOU ARE READY TO CONTINUE, PRESS 'RETURN':

----------------------------------------------------------

DATA COLLECTION SOURCE FIVE: SPECIAL CONDITIONS DATA

Special Conditions Data is the fifth option on the menu.

The user would be presented with introductory comments found on Screen twenty-one.

SCREEN TWENTY-ONE

----------------------------------------------------------

***************DATA COLLECTION SOURCE FIVE***********************

***************SPECIAL CONDITIONS DATA***********************

K-BAS HAS BEEN DESIGNED TO ACCEPT DATA OF A SPECIAL NATURE WHICH MIGHT HAVE AN EFFECT UPON THE EMPLOYEE ASSESSMENT. THE INCLUSION OF THESE DATA SERVES TO SUBSIDIZE THE ALGORITHM SO THAT THE EMPLOYEE CONCERNED RECEIVES ADDITIONAL POINTS TOWARDS FORMATION OF THE STATUS RECOMMENDATION. AS WITH OTHER K-BAS DATA, A WEIGHTING HAS BEEN ASSIGNED TO EACH AVAILABLE OPTION. YOU WILL NEED TO SELECT THAT OPTION REPRESENTING THE CONDITION YOU WISH TO INCLUDE AND ENTER THE APPROPRIATE CODE.

PRIOR TO DATA ENTRY FOR THIS SECTION, YOU SHOULD HAVE THE FOLLOWING MATERIALS: (1) ANY DATA YOU WISH TO ENTER.

IF YOU DO NOT HAVE DATA YOU WISH TO ENTER, PLEASE EXIT THIS SECTION BY ENTERING "1".

PRESS "ENTER" IF YOU WISH TO PROCEED.

INDICATE YOUR CHOICE HERE:

------------------------------------------------------------------
The user has an option in this section not provided in others -- to exit or continue. The nature of the data in this section mandates this option; the employee being evaluated may not have been affected by any of these conditions. A default in this section has a neutral impact upon data. If the user continues into the data entry section, comments displayed on Screen twenty-two are seen.

SCREEN TWENTY-TWO

***********DATA ENTRY SECTION SPECIAL CONDITIONS DATA ***********

PLEASE INDICATE IF ANY OF THE FOLLOWING CONDITIONS WERE PRESENT DURING THE ASSESSMENT PERIOD. ENTER THE APPROPRIATE NUMERICAL DESIGNATION TO INCLUDE THESE DATA. THE SYSTEM Allows FOR THE ENTRY OF TWO SOURCES OF DATA. IF YOU HAVE ONLY ONE PIECE OF DATA, YOU SHOULD ENTER A "ZERO" AT THE PROMPT FOR THE SECOND DATA.

DEATH OF FAMILY MEMBER : ENTER 3.13
BIRTH IN THE FAMILY : ENTER 1.75
PHYSICAL IMPAIRMENT OF FAMILY MEMBER : ENTER 2.50
PHYSICAL IMPAIRMENT OF EMPLOYEE : ENTER 4.13
EMOTIONAL DISABILITY IN FAMILY : ENTER 3.50
EMOTIONAL DISABILITY OF EMPLOYEE : ENTER 4.20
MARRIAGE OR DIVORCE : ENTER 2.50
RECIPIENT OF A MAJOR AWARD : ENTER 3.00
MAJOR ACCOMPLISHMENT : ENTER 3.00

ENTER THE NUMBER WHICH REPRESENTS DATA SOURCE ONE:

The program requires that the user enter (at the prompt) the appropriate rank for the datum to be evaluated. If a second piece of datum is to be entered, it will be inserted at this point. If the user does not have a second piece of datum, a zero is to be placed at the prompt requesting such. K-BAS then presents those data entered for verification as in Screen Twenty-three.
YOU HAVE ENTERED THE FOLLOWING DATA:

SOURCE ONE   SOURCE TWO
    1       2

ENTER "1" IF YOU WISH TO REENTER DATA.
PRESS 'RETURN' IF YOU WISH TO PROCEED.
INDICATE YOUR CHOICE HERE:

After the user is satisfied with the data entry, K-BAS presents the aggregate sum for this data collection source and redirects the user to the menu. Screen twenty-four depicts aggregate sum data.

THE AGGREGATE SUM FOR THESE DATA EQUALS:

THIS SUM WILL BE WEIGHTED AND PLACED IN THE ASSESSMENT ALGORITHM.

WHEN YOU ARE READY TO CONTINUE, PRESS 'ENTER':
DATA COLLECTION SOURCE SIX: PERFORMANCE RECORD DATA

Option six, Performance Record Data, is the final data collection source. The introductory text for this section is presented on Screen Twenty-five.

SCREEN TWENTY-FIVE

**************************************DATA COLLECTION SOURCE SIX*****************************
**************************************PERFORMANCE RECORD DATA*****************************

K-BAS USES DATA COLLECTED FROM PREVIOUS PERFORMANCE EVALUATIONS. THESE DATA ARE PLACED IN THE STATUS ALGORITHM. YOU WILL BE ASKED TO ENTER A RANK REPRESENTING THE AGE OF THE DATA YOU ARE USING AND TO INDICATE THE STATUS OF YOUR DATA -- WAS IT POSITIVE OR NEGATIVE. YOU WILL NEED TO ENTER THREE SOURCES OF DATA TO ALLOW THE ALGORITHM TO FUNCTION.

WHEN YOU ARE READY TO CONTINUE, PRESS "ENTER" :

At this point, the user should have three pieces of data from different years illustrative of the teacher's performance. Data are rated by their year of origination and by their status -- positive or negative in terms of ratings. The data ranks can be seen in Screen Twenty-six.
**DATA ENTRY SECTION: PERFORMANCE RECORD DATA**

Indicate the appropriate rank for each of the data you will be entering. You will need to enter three sources of data to allow the algorithm to function. Please use the following ranking system.

- DATA FIVE YEARS OF AGE: ENTER 1
- DATA FOUR YEARS OF AGE: ENTER 2
- DATA THREE YEARS OF AGE: ENTER 3
- DATA TWO YEARS OF AGE: ENTER 4
- DATA ONE YEAR OLD: ENTER 5

Enter the appropriate rank for your data:

The status of the data is requested in Screen Twenty-seven.

**SCREEN TWENTY-SEVEN**

You will also need to enter the status of your data. These weights have been determined as indicative of data status:

- POSITIVE DATA: ENTER 2
- NEGATIVE DATA: ENTER 1

Enter the appropriate status for your data:

In Screen Twenty-eight, K-BAS offers the user a verification check.
YOU HAVE ENTERED THE FOLLOWING DATA:

<table>
<thead>
<tr>
<th>DATA</th>
<th>RANK</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOURCE ONE</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>SOURCE TWO</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>SOURCE THREE</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

ENTER "1" IF YOU NEED TO REENTER DATA.
PRESS "ENTER" IF YOU WISH TO PROCEED.
INDICATE YOUR CHOICE HERE:

After the data has been accurately entered, the user is directed to Screen Twenty-nine which presents the aggregate sum and redirects the user to the menu.

THE AGGREGATE SUM FOR THESE DATA EQUALS:

THIS SUM WILL BE WEIGHTED AND PLACED IN THE ASSESSMENT ALGORITHM.

WHEN YOU ARE READY TO CONTINUE, PRESS "ENTER":

After data has been successfully entered for each of the six data collection sources, the user will proceed to menu option seven,
Total Algorithm Representation. The introductory screen presents comments displayed in Screen Thirty.

SCREEN THIRTY

**************************************************TOTAL ALGORITHM REPRESENTATION**************

THE DATA YOU HAVE ENTERED HAS BEEN ANALYZED AS DESCRIBED IN THE INTRODUCTION TO THIS PROGRAM AND AS SPECIFICALLY DELINEATED IN THE RESOURCE MATERIALS ACCOMPANYING THIS SOFTWARE. IT MUST BE EMPHASIZED THAT THE RESULTANT STATUS ASSIGNMENT SHOULD BE CONSIDERED AS ANOTHER TOOL TO BE USED IN THE EVALUATION PROCESS. IT MUST BE PLACED IN THE APPROPRIATE CONTEXT AND PAIRED WITH OTHER ASSESSMENT PROCEDURES.

WHEN YOU ARE READY TO CONTINUE, PRESS "ENTER":

**************************************************

The user is provided with the data which will be used in the determination of the status recommendation. This allows the user to make a final check for accuracy before the data are accepted by K-BAS as legitimate. Screen thirty-one displays this check.
THE FOLLOWING DATA HAVE BEEN USED TO DEVELOP THE STATUS RECOMMENDATION.

<table>
<thead>
<tr>
<th>DATA</th>
<th>AGG.SUM</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRITERIA</td>
<td>245.6</td>
<td>3.33</td>
</tr>
<tr>
<td>ANC. Notat.</td>
<td>25.3</td>
<td>2.50</td>
</tr>
<tr>
<td>Intervention</td>
<td>5</td>
<td>2.83</td>
</tr>
<tr>
<td>Achievement</td>
<td>3</td>
<td>4.00</td>
</tr>
<tr>
<td>Spec. Cond.</td>
<td>3.46</td>
<td>1.67</td>
</tr>
<tr>
<td>Performance Rec.</td>
<td>15</td>
<td>3.17</td>
</tr>
</tbody>
</table>

THESE DATA YIELD A TOTAL ALGORITHM SCORE OF:

PRESS "ENTER" WHEN YOU ARE READY TO PROCEED TO THE NEXT SCREEN:

The user is now ready to receive the effectiveness classification. Screen thirty-two displays this recommendation.

SCREEN THIRTY-TWO

This score results in a status recommendation for your data of maintenance.

PRESS "ENTER" TO RETURN TO THE MENU:

At this point, the user has the option of using the system to complete another evaluation, or of terminating the program.
Program termination (option eight) results in the system thanking the user and closing the file.

CONCLUDING REMARKS

K-BAS is a hybrid system. It uses conventional linear programming in consort with expert knowledge. It is the hope of its author that the product will evolve into a more sophisticated system. Developmental efforts will be directed to this end.

This manual has been written to address operational aspects of software use. The user should reference appropriate MS-DOS materials for information on program loading, invocation, maintenance, etc. Special commands required by hardware other than IBM may need to be taken into consideration.