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ABSTRACT

This paper presents an analysis of the factors influencing human decision making, and its implications for the judgments and choices that result from juxtaposition of data with decision content. The analysis serves as a background for the consideration of selected issues regarding the specificity of information in data-based decision making in schools. The text is divided into the following sections: (1) reasons for focussing on specificity of information during the course of the Systemic Evaluation (SE) Project; (2) issues that influence the choice of appropriate specificity of information in data-based decision making in schools; (3) application of points raised during general analysis to the work on instructional information systems; (4) examples from existing practice illustrate specificity choices; and (5) suggestions intended to advance the state of practice with regard to balancing the competing factors that impinge the choice of specificity in data-based decision making in schools. (LMO)

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Systemic Evaluation Project

SPECIFICITY OF INFORMATION IN DATA-BASED DECISION MAKING IN SCHOOLS

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SPECIFICITY OF INFORMATION IN DATA-BASED DECISION MAKING IN SCHOOLS

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> Making decisions is like speaking prose--people do it all the time, knowingly or unknowingly.... The study of decisions addresses both normative and descriptive questions. The normative analysis is concerned with rationality and the logic of decision making. The descriptive analysis, in contrast, is concerned with people's beliefs and preferences as they are, not as they should be. The tension between normative and descriptive considerations characterizes much of the study of judgment and choice.(Kahneman and Tversky, 1984,p.341)

The above quotation, taken from the 1983 American Psychological Association Award address by Amos Tversky, carries a message with multiple meanings that reverberate throughout the latest round of efforts to use information efficiently and effectively to improve educational quality. The message is that as in other areas of human endeavor, the benefits of data-based decision making in schools are not inherent but derived from the circumstances in which it is attempted. On the one hand, removed from the context of the decision, the quality of the data available for decision-making can be normatively established through generally agreed-upon technical standards. On the other hand, someone or some group makes the decision. Thus in any specific instance, the human beliefs and preferences of the decision-maker(s) impose their own meaning and "context" on the

data upon which the decision is intended to be based. The picture is further complicated (muddled?) in that the human beliefs and preferences guiding individual action are likely to be influenced by the social and historical context, i.e., by the societal, political and organizational circumstances prevailing at the time when the decision must be made.

This analysis of the factors influencing human decision making, and its implications for the judgments and choices ("decisions") that result from juxtaposition of data with decision context, serve as a backdrop for the consideration of selected issues regarding the specificity of information in data-based decision making in schools. The term "specificity of information" refers to the units of information and their degree of divisability or decomposability. Specificity is a relative attribute. In terms of data collection and reporting in educational practice, the most specific piece of information (data) is typically the response of an individual to a single question (test question, survey item, demographic question) or the classification of a higher organizational unit (classroom, school, district, state, country) on a single attribute (e.g., remedial class, private school, Southeastern state, industrialized country). Summarizations (counts, averages, totals, etc.) across persons for a given question or across questions for a given person, or both, yield less specific data.

Different summarizations over a person(organizational unit)-attribute array of data result in different degrees of specificity of information. The question then is <u>how does the choice among alternative summarizations, and hence the</u>

specificity of information, interact with decision contexts to influence data-based decision making in schools. In our examination of this question, we draw upon work from efforts to improve the quality and utility of information use for educational decision-making through the creation of instructional information systems in schools (Bank & Williams, 1983a, 1983b, 1985; Burstein and Sirotnik, 1984; Cooley & Bickel, 1985; Hathaway, 1984; Idstein, 1984; Sirotnik, Burstein & Thomas, 1983). In the instructional information systems (IIS) movement, the increasing availability of amenable technology (the hardware, software, and human resources for educational uses of computing) has made it possible for school districts throughout the country to develop comprehensive information systems to inform educational decision making at various levels within the districts.

The remainder of the paper will proceed as follows. In the next section, our reason for focussing on the specificity of information point in light of the variety of issues and concerns that have arisen during the course of the Systemic Evaluation (SE) Project is provided. We then consider selected issues that in theory should influence the choice of appropriate specificity of information in data-based decision making in schools. The points raised during the general analysis in Section 3 are then applied to the work on instructional information systems (section 4). In this section, examples from existing practice are used to illustrate the specificity choices that actually are made and what these choices imply about the

features of the decision context. The paper concludes with suggestions intended to advance the state of practice with regard to balancing the competing factors that impinge the choice of specificity in data-based decision making in schools.

Intellectual Antecedents of the Paper

From its inception the SE Project has been concerned with the use of comprehensive information from multiple sources (students, teacher,s local school and district administrators, parents, community members) about the context, processes, and practices in local school settings that can be used in efforts to improve the quality of schooling (Burstein and Sirotnik, 1982; 1984). This concern reflected the integration of two highly interrelated conceptual perspectives (contextual appraisal and multilevel evaluation design and analysis), one derived from experiences in studying schooling and informed by a specific ideology regarding educational change (Sirotnik) and the other derived from perceived methodological inadequacies of most large-scale research and evaluation efforts focussing on educational (school, classroom, teacher, program) effects (Burstein).

The primary focus of the SE Project itself was on the contents of comprehensive information systems, their uses at the student, classroom, school, and district levels; and the mechanisms that enhance the likelihood that such systems would become ongoing and enduring components of the school improvement process. In contrast to the complementary CSE work of the Management of Instructional Information Systems Project (Bank and Williams, 1984), the SE work emphasized the nature, technical organization, and presentation of the information itself as well

as the fit between the information and information delivery with the needs of diverse school personnel.

Despite its intended thrust and emphasis, a reading of the most recent set of SE project reports (Dorr-Bremme, 1985; Sirotnik, Dorr-Bremme, & Burstein, 1985; Sirotnik & Burstein, 1985) clearly depicts the impact of human and environmental conditions (interpersonal, social, organizational, political) on information selection and use. In fact, one might reasonably conclude that the impact of these conditions exceeds that of the technical and methodological features of competing alternatives at virtually every step along the way in developing, implementing, and using the information system in our case study school.

This result is consistent with findings from Bank and Williams' research and from the papers and discussion at the February 1985 CSE conference on Information Systems and School Improvement: Inventing the Future. From Bank's socio-organizational perspective (also reflected heavily in Dorr-Bremme, 1985), this phenomenon might be construed alternatively as a) a natural consequence in an environment (clearly characteristic of our case study site) where the debate between "teaching as a craft/schools as organic communities" and "teaching as technology/schools as bureaucratic institutions" rages on; b) as an instance where the compatibility and incompatibility of assumptions and values underlying education on the one hand and management information systems on the other are evident; and c) as a familiar reaction of an educational

organization to the change process itself with the information system serving as the technological innovation.

While these socio-organizational explanations for the relative importance of human and environmental conditions are both compelling and appealing, they do not exhaust the possibilities that can account for the results from our case study. Moreover, these socio-organizational explanations do not lead necessarily to a system design in other organizational settings that is viable for the decision contexts in which they are introduced. Perhaps basing the design of information systems on principles derived from the psychology of human decision making in context is a more functional strategy, leading to an improved fit between the inherent qualities of information and its value and utility within its desired decision context.

This present paper then is in response to curiosity about whether ideas developed from the literature on the psychology of human decision making might warrant greater consideration in the current attempts at data-based decision making in schools. The focus on the presumably technical/methodological choices regarding the specificity of information hopefully accomplishes its intent of grounding the theoretical arguments within the practical school settings in which decisions are intended to be made.

Choosing the Appropriate Specificity of Information

As was pointed out at the beginning of the paper, multiple factors can impinge on the judgments of the quality of data for decision making. Normatively established *ceteris parabus*

technical considerations must be balanced against the human and environmental circumstances that inhere in the decision context. The extensive literature on the psychology of human decision making (The work of Tversky and Kahneman (e.g., Kahneman & Tversky, 1979; 1984; Kahneman, Slovic, & Tversky, 1982; Tversky & Kahneman, 1981) is the most widely cited and acclaimed although the topic of decision making is shared by many disciplines.) offer possible explanations for choices that are likely to be made in such circumstances.

The following simple heuristic model for data-based decision making may help to focus the discussion. Let CASI denote the decision of interest, in this case the Choice of Appropriate Specificity of Information. If ITQI denotes the Inherent Technical Quality of the Information, CDM denotes the characteristics of the decision-maker(s), and EC denotes the environmental circumstances component of the decision context, then the decision can be modeled as follows:

$$CASI = f(ITQI \underline{x} CDM \underline{x} EC) \qquad (1)$$

(In the equation, the symbol $\underline{x}$ is used to specify that the relationship may be interactive rather than simply additive.)

Each of the factors influencing the decision has its own potentially multidimensional composite of attributes that accounts for its salience with regard to the decision of interest. Several of the major attributes of these factors with

respect to the specificity of information within a data-based decision making in schools context will be discussed next.

Inherent Technical Quality of Information

The question of the appropriate specificity of information is governed in part by inherent features of the technical quality of information. Holding other factors constant, we can say the following with regard to the relationship between the technical quality of information and its specificity:

1. Assuming perfect measurement and infinite capacity to assimilate information, the technical quality of information is directly related to its specificity. Thus the full person-attribute array of information is of technically higher quality because it retains more of the information than any other choice of degree of specificity. According to this standard, finer content distinctions (e,g, subskills rather than skills) on achievement tests; the responses to single items from surveys rather than the scales composed from the items; and the scores of individuals as opposed to the aggregated scores for the groups (classes, schools, etc.) to which they belong are of higher quality than their alternative. These conclusions hold regardless of the underlying dimensionality of the responses.

2. The assumption of infinite capacity to assimilate information is practically untenable. At some point the amount of information to process exceeds an individual's capacity to process it and employ it effectively. While this tipping point might vary across individuals (a point relevant to the discussion of decision maker characteristics later on), once the available information exceeds the tipping point, the quality (in terms of

its value to improving judgment and choice) of the additional information is minimal at best. At worst the information overload that results inhibits judgment; in such instances the quality of the complete set of available information deterioriates. The implication of this phenomenon for the choice of specificity of information is that at some point, information reported in a less specific form (through summarization or selective reporting) may be of higher quality than the complete data array. One could argue that this provides the substantive rationale for interest in the fields of statistics and data analysis.

3. The assumption of perfect measurement in obtaining information is also likely to be untenable. Human responses to stimuli (questions) are likely to vary depending on the conditions under which the responses are elicited. These conditions include features of the occasion (time of day, period in time, physical setting, organizational setting, etc.) and of the stimuli (content, type, wording, format, and location of the question among others). Variability of response (either systematic or random) on a condition that is irrelevant to the decision of interest reduces the quality of the information with respect to that decision. Summarization over responses associated with such conditions improves information quality by reducing the noise associated with variation on the condition. Here, again, less specific information can be of higher quality than more specific. As in point 2, concerns for the impact of relaxing a basic assumption about information quality leads us directly to a field of quantitative methodology (in this case

psychometrics with its basic concepts for the validity, reliability and scaling of measurments). Summarizations that improve the validity, reliability, and scale properties of information <u>for a given decision</u> lead to higher quality information.

While other factors might be mentioned, the three already cited (degree of specificity (SP), mass or volume of information (IM) and psychometric quality (PQ)) largely determine the inherent technical quality of information (ITQI). These factors operate interactively and in the case of information mass nonlinearly. Accordingly, the relationship can be written as follows:

$$ITQI = f(SP \times IM \times PQ) \qquad (2)$$

Characteristics of the Decision Maker(s)

A complete delineation of the characteristics of the decision maker that might influence their response to information will not be attempted. With respect to judgments about the appropriate choice for specificity of information, the most salient characteristics of the decision maker would appear to be the knowledge base with respect to both the decision of interest and the technical qualities of data, the ascriptive features of their role in the educational setting, and values and preferences with respect to both their role and to the utility of information in educational decision making. We discuss each of these sets of characteristics briefly below.

Knowledge Base

The decision maker brings to the decision contexts an array of understandings about the decisions to be made and the intended bases for the decision. One subset of this knowledge base has to do with the decision of interest. Stated simply, a naive decision maker responds differently from an experienced decision maker. A teacher who has never taught a specific lesson or a specific class of students responds differently from another with extensive practice or familiarity with the material or class.

Individual differences in the decision maker's understanding of the technical properties of information are also important. In most school settings there is likely to be substantial variation in understanding of statistical and psychometric concepts among teachers and administrators. Given the dependence of most information system applications on some common body of knowledge with respect to the properties of tests and questionnaires (not to mention the instructional, curricular, and psychological theory underpinning the choice of information to collect and report), it is obvious that this source of decision maker knowledge is likely to have a significant impact.

We decided not to include a separate "dimension" to represent individual differences among decision makers in their capacity to assimilate information (see earlier discussion about the effects of what we have termed mass of information). To some degree this capacity is learned through training and experience. Regardless of its source, this attribute is hard to disentangle from other characteristics of the decision maker knowledge base in practice.

Role in Educational Setting

The point of mentioning this characteristic is to simply highlight the fact that the roles and job responsibilities of the decision maker within the organization influence the reaction to information. Teachers' information needs are different from administrators because of the differences in job responsibilities and hence decisions that must be made based on data. The same could be said for other professional and lay categories of interested parties in educational settings (e.g., counselors, parents, school board members, students).

Roles within a category also vary in responsibilities as well. For instance, teacher responsibilities are typically quite different for primary schools with their intact classrooms versus secondary settings with multiple sections of varied subject matter content. Likewise the role of the school administrator will also change from primary to secondary schools. (This point was discussed in greater detail in an early project report (Burstein, 1983) and served as one of the main justifications for the choice of a secondary school focus of the SE Project work on information systems.)

Values and Preferences

The American penchant for individuality and autonomy in thought and action is very evident in the diverse ways in which school personnel approach their educational responsibilities. Orientations toward education in general, beliefs about the purpose of schooling (e.g., relative importance of academic, social, personal, and vocational development of students), views

about what to teach and how to teach and about teacher vs. student responsibility for student learning all vary substantially. Also committment to work and the valuing of student growth and development relative to other personal and economic concerns on the part of school personnel also need to be considered in anticipating the possible reaction to information intended to inform decision making in schools. (Other project reports (Dorr-Bremme, 1985; Sirotnik & Burstein, 1985) highlight these points.)

With respect to the more specific issue of beliefs about and reaction to empirial information, the picture is also one of substantial inter-individual variability within school settings. Setting aside strictly knowledge-based considerations, there remains a sense that the reaction to numerical information on the part of many presumably well-trained professionals is more extreme (other positively or negatively) than is desireable for the effective functioning of data-based decision making in schools. In many educational settings, there is virtually no middle ground between the overinterpretation (e.g., the faith in test scores from a standardized test) to accurately reflect student knowledge and ability, leading to prescriptions about what to "expect" the student to learn) and underutilization (e.g., "teaching is an art. Therefore information about student abilities, backgrounds and beliefs are irrelevant"; "I get all the information I need about students from my own observations of them."; " My job is to cover the subject matter, regardless of what the data might say about the students in my class.") of information that might inform educational decision making.

The above litany about diversity of beliefs and preferences of school personnel in our educational system pinpoints the dilemma faced by designers of information systems for data-based decison making in schools. For which type of personnel should the system be designed? Must there be a critical mass of personnel within a setting with commonality of purpose, beliefs and preferences to warrant devoting resources to developing information systems? Many of the contributions to Bank and Williams' book (1985) deal with variations on this topic; it is also a major theme of Dorr-Bremme's analysis the reasons why our case study worked as it did. Certainly there are instances where the complications associated with diversity have been manageable (e.g., Cooley & Bickel's work), but the difficulties of creating an information system responsive to the diversity in schools remains a major obstacle to such efforts.

Environmental Circumstances

The extra-individual and extra-data circumstances of time and place clearly must be figured into any equation purporting to account for the appropriate choice of specificity of information for data-based decision making in schools. Virtually all of the accounts of efforts to develop such systems (e.g., Bank & Williams, 1983; Coleman & Karweit, 1972; Cooley & Bickel, 1985 in addition to our own work) vividly portray the impact of social, organizational, political, and historical conditions, both internal and external to the setting, on their development, implementation, and ultimate use.

Within our own study, the influence of these environmental conditions are considered extensively in Dorr-Bremme's (1985) discussion of the social organization of the school (scarcity of time and limited communication, multiple agendas in the school, distribution of power and division of roles, the district contex) and of leadership and support. Obviously, the presumably distinct perspectives (social organization versus the psychology of human decision making) begin to merge at this point even though a social organizational viewpoint concentrates on the details of the environmental conditions themselves while the human decision making viewpoint reflects outward from the decision maker upon those features of the environment that are likely to influence behavior.

Two additional points warrant special mention in the discussion of environmental circumstances. First, there is a clear need to attend to compositional influences as an environmental factor of import for decisions about information specificity. The characteristics of other decision makers within the setting (other teachers, administrators, etc.) establish a common or diverse peer culture within which an individual decision maker must function. An individual's actions (in this case, responsiveness or resistance to information) are likely differ if she or he is placed in a setting composed of colleagues with a different profile of characteristics.

Second, it is hard to over-emphasize the influence broader societal circumstances operating at the given moment in time have on the decision making process. Schools go through historical periods where the impetus for action is internally motivated,

driven by self-examination mixed with opportunity (in the form of resources (intellectual, psychological, economic) to support change efforts). At other times, the motivations for actions are more externally derived; national concerns about the condition of education, calls for educational accountability, and reforms originating from the state and federal level are clear instances of the latter.

These types of external pressures cast a different pallor over efforts to employ information systems in school improvement. Most of the discussions about the value of ownership of ideas get lost to the pressures to react to external barometers of well-being. One often finds an entirely different set of criteria employed to develop systems in response to these external pressures. It is also reasonable to expect that a different set of decision maker characteristics (e.g., survival skills) are likely to be salient in the decision making process, and consequently, in the choice of appropriate specificity of information.

Examples from Instructional Information Systems Work

Above we have raised the question of whether a psychology of human decision making perspective might be applicable to the choice of appropriate specificity of information in data-based decision making in schools. We then proceeded to delineate the components such a model would entail. In this section we illustrate how both the model and its components can be used to interpret the selection of degree of specificity of information in several instructional information systems. Our illustrations are necessarily selective as the combinations of information

features with decision maker characteristics and environmental conditions expands quite rapidly. Moreover, most of the examples will be drawn from our own work and from school districts participating in Bank and Williams' projects. (We will retain the practice from our earlier reports of maintaining the anonymity of the districts although the examples were taken from non-copyrighted documents appearing in the public domain.)

Example 1 -- Instructional Management System

The first set of examples are sample reports from an instructional management system (IMS) in operation a medium size district on the East coast. The system was designed to among other things):

1. implement district-wide measures of student progress through the basic skills curriculum
2. enable teachers to determine student academic status throughout the school year (including articulation from grade-to-grade)
3. provide teachers and administrators with targeted information for efficiently evaluating student progress and instructional programs
4. establish an unambiguous basis for communicating student progress to parents.

The system description indicates that 2600 tests measuring 1300 objectives (over all grades) in the basic skills are contained in the system. A student takes an IMS test when the teacher thinks the student has mastered a skill. The teacher gets a report back immediately and student records at the district level are updated daily. Parents receive reports periodically.

Data Displays Exhibits 1 through 3 are reasonably typical of the reports generated by instructional management systems. These

reports are targeted to the classroom teacher (a parent version of Exhibit 1 provided a list of objectives mastered and not mastered with each objective described by a brief statement (e.g. "write a ratio for a word problem using ratios")).

the exhibits differ in degree of specificity of information and in the types of decisions they are intended to inform. Exhibit 1 is a virtually complete record of student status with respect to the objectives in grade 8 mathematics. This sheet is presumably for the teacher's file to assist in parent conferencing and keeping track of w' t a given student has to complete in the math curriculum. The report is virtually devoid of numbers (not even a running tabulation of total objectives mastered) and there is nothing to suggest any concern for the psychometric basis for the student master/non-master classification on a given objective. Moreover, all objectives are given equal billing.

What does Exhibit 1 suggest about what designers presume about the characteristics of teachers? First, the sheer number of objectives (31 objectives from 11 skill areas) presented with limited elaboration suggests that the teachers are presumed to be competent subject-matter specialists capable of fine-grained distinctions in their teaching. Second, the absense of numerical information and statistical and psychometric summarizations would seem to indicate that teachers are either not expected to have significant quantitative or assessment expertise or that this report is simply to serve a more limited purpose (see earlier comments). Basically, the decisions Exibit 1 could inform appear to be limited to those dealing with a

INSTRUCTIONAL MANAGEMENT SYSTEM Date:
MIDDLE SCHOOL

INDIVIDUAL REPORT - CRITICAL OBJECTIVES

Jane Doe ID # 459549

OBJ #	DMC	Current STATUS	# Trials	-A- Form	-B- Form
Addition					
*M08AD01		MASTERY	1	04/10/84 (A) +	
Decimals & Percents					
*M08DC01.1D		NON-MASTER		05/14/84 (A) -	06/05/84 (B) -
*M08DC02.1C		NON-MASTERY	2	04/03/84 (A) -	06/05/84 (B) -
*M08DC03.2G		MASTERY	2	04/03/84 (A) -	06/05/84 (B) +
*M08DC04.2G		NON-MASTERY	2	04/03/84 (A) -	06/05/04 (B) -
*M08DC05.2G		MASTERY	1	03/20/84 (A) +	
*M08DC06.5C		NON-MASTERY	2	03/20/84 (A) -	06/05/84 (B) -
*M08DC10.3B		MASTERY	1	05/14/84 (A) +	
*M08DC11.3C		MASTERY	1	05/01/84 (A) +	
*M08DC12.2I		NON-MASTERY	2	05/01/84 (A) -	06/05/84 (B) -
Division					
*M08DV02.		MASTERY	1	04/10/84 (A) +	
Fractions					
*M08FR01.1B		NON-MASTERY	2	04/10/84 (A) -	06/05/84 (B) -
*M08FR02.2E		NON-MASTERY	2	05/01/84 (A) -	06/05/84 (B) -
*M08FR07.2J		MASTERY	1	05/14/84 (A) +	
Geometry					
*M08GM04.		NON-MASTERY	1		06/05/84 (B) -
*M08GM06.3L		MASTERY	1	05/14/84 (A) +	
*M08GM08		MASTERY	2	05/14/84 (A) -	06/05/84 (B) +
*M08GM11.3M		MASTERY	1	05/14/84 (A) +	
Multiplication					
*M08ML01.		MASTERY	1	04/10/84 (A) +	
*M08ML02.5B		NON-MASTERY	2	04/10/84 (A) -	06/05/84 (B) -
Measurement					
*M08MS01.5D		MASTERY	1	05/01/84 (A) +	
Numeration					
*M08NM01.1A		MASTERY	1	04/10/84 (A) +	
Number Theory					
*M08NT01.		MASTERY	1	05/14/84 (A) +	
*M08NT05.		MASTERY	2	05/01/84 (A) -	06/05/84 (B) +
*M08NT06.		NON-MASTERY	2	05/01/84 (A) -	06/05/84 (B) -
*M08NT07.		NON-MASTERY	2	05/01/84 (A) -	06/05/84 (B) -
*M08NT08.		MASTERY	2	05/14/84 (A) -	06/05/84 (B) +
*M08NT09.		MASTERY	2	05/14/84 (A) -	06/05/84 (B) +
Subtraction					
*M08SB01.5B		MASTERY	2	04/10/84 (A) -	06/05/84 (B) +
Statistics, Probability, & Graphing					
*M08ST01.4B		MASTERY	2	05/01/84 (A) +	
*M08ST03.		MASTERY	2	05/14/84 (A) -	06/05/84 (B) +

specific student's progress and are more for description than for evaluation.

Exhibit 2 contains a student-by-objective grid for the class as a whole. There is again a substantial amount of specificity and limited summarization. The codes for reporting status are again non-numeric. This report is presumably intended to provide a ready reference for the teacher of objectives that the class, or a group, have yet to master (working down a column) or students who have a lot of objectives to be completed (working across a row). This particular report was generated early in the year so one might presume that general content selection decisions and any decisions about instructional grouping might be informed by this information display. There is, again, a strong indication that the teacher, as the decision maker designated to use these data, can tolerate a substantial amount of specificity if it's curricularly and instructionally targeted and not heavily numerical. Also, psychometric properties of the tests themselves or the reporting categories are unimportant.

The specificity in Exhibit 3 is again substantial but focussed on a different type of decision that the teacher might make. Here the instructional objectives is the focus and student's actual item response patterns on the test of the objective are reported. The feedback loop is short term here as this information is intended to inform the teacher about the kinds of misunderstandings that remain after instruction on the objective. For example, note that many students (15 of 32) chose alternative C for item 2. If this item taps an aspect of the

Exhibit 2

INSTRUCTIONAL MANAGEMENT SYSTEM
MIDDLE SCHOOL

CIMS GROUP MATRIX REPORT
CRITICAL OBJECTIVES

```
                M    (Math)

                0    (
                     ( Grade 8
                8    (

     (Strands)  ADDDDDDDDDDFFFGGGGMMMNNNNNNNSSS
                DCCCCCCCCCVRRRMMMMLLSMTTTTTTBTT
  (Objectives)  00000001110000000100000000000000
                11234560122127368112111567891 13

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

Jones, John      ????????? ???????  ?    A ?A??
Doe, Susan       XXXXXBA XA?X XAA X? BB XXBB? B
Smith, Joseph    X XX      AB AXA  A  XX X
Johnson, Thomas  XX X X  X XX B    X    XX
Brown, Alex      ????????? ???????  ? A  A   ??
```

```
*****************************************
*                                       *
*                                       *
*        ? = no test data               *
*   (blank) = mastery                   *
*        A = non-mastery (Form A)       *
*        B = non-mastery (Form B)       *
*        X = non-mastery (Forms A & B)  *
*        T = Teacher certified mastery  *
*        a = Teacher certified non-mastery A *
*        b = Teacher certified non-mastery B *
*                                       *
*****************************************
```

Exhibit 3

INSTRUCTIONAL MANAGEMENT SYSTEM
SUMMARY REPORT BY OBJECTIVE

OBJECTIVE CODE = W05GR01
Given a passage with nouns underlined and choices of pronouns, correctly substitute pronouns for nouns.

NON-MASTERY STUDENT	FORM	DATE	CORRECT	ITEMS
264503 LOA SHE. ON	A	11/17/83	2	(AC++A)
457358 FOX RID. L	A	11/17/83	3	(+C+A+)
671827 . ORE RYAN	A	11/17/83	3	(+C++A)
803346 G. RTN. ROB. M	A	11/17/83	3	(+A++A)

TOTAL NON-MASTERY (Count = 4):

MASTERY STUDENT	FORM	DATE	CORRECT	ITEMS
010923 ACKS N CYI IA	A	11/17/83	5	(+++++)
011018 UBA R CRA R	A	11/17/83	4	(++C++)
011043 F EGA. EATH. D	A	11/17/83	5	(+++++)
011090 SA. DEV M I	A	11/17/83	4	(+C+++)
011115 VAL. NT C. STIN	A	11/17/83	4	(+C+++)
011370 GEHRA NN B. TANY	A	11/17/83	4	(+C+++)
011391 NAGH KEV L	A	11/17/83	4	(+C+++)
011410 C VELA. PAT. CIA	A	11/17/83	4	(+C+++)
011415 ZL JEWS. BROC A	A	11/17/83	5	(+++++)
011421 MIN KEV J	A	11/17/83	4	(+C+++)
011422 PRESA STE. NIE D	A	11/17/83	5	(+++++)
011437 BSTE BRO E	A	11/17/83	5	(+++++)
025213 F NN M. HAEL	A	11/17/83	5	(+++++)
128528 S. ER F. DERI. M	A	11/17/83	4	(+C+++)
154764 SM JOH CHRI OPHER	A	11/17/83	5	(+++++)
207147 SON JON HAN	A	11/17/83	5	(+++++)
207272 GAROF. JUL A	A	11/17/83	5	(+++++)
238749 REVOOA JOSE W	A	11/17/83	4	(+C+++)
369298 NN ME. E	A	11/17/83	4	(++++A)
562525 W E WILL M A	A	11/17/83	5	(+++++)
570828 WAL HEATHE K	A	11/17/83	4	(++++A)
573861 KAUF. D JIL.	A	11/17/83	5	(+++++)
574064 EMERSO. TAMIE	A	11/17/83	5	(+++++)
584967 STEN RIFAH	A	11/17/83	5	(+++++)
649624 C INGS RISTI.	A	11/17/83	4	(+C+++)
702145 CAW. BRI.	A	11/17/83	4	(+C+++)
826440 MALO CHEL	A	11/17/83	4	(+C+++)
839335 . RX AL. J	A	11/17/83	5	(+++++)

TO MASTERY (Count = 28):

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objective that was covered by the teacher, perhaps some targeted review is in order.

Implicit Model of Decision Making. Stepping back from the separate exhibits to consider the set as a whole, we obtain a reasonably consistent profile of the designers' implicit model for teacher decision making about instruction and its impact on the choice of specificity of information. With respect to the inherent qualities of the information (ITQI), instructional decisions seem to require very detailed information targeted to individual students (high SP). When so targeted, teachers can assimilate a large amount of information (high IM). Also psychometric properties of information are not very important (low concern for PQ); presumably, the opportunity for remediation and re-examination in the case of a false negative is sufficient protection against poor data quality.

We have already pointed out that the implied knowledge base for the decision maker leans heavily on their curriculum expertise while presuming little about their numerical competence and psychometric understanding. The role of the primary decision maker (the teacher) is that of the content specialist. A mastery learning model underlines the system and it is presumed that the teachers are interested in test results and are willing to build in rerouting (additional instruction for a subset of students on topics already covered or reteaching topics with generally poor mastery). Application of a common curriculum model across teachers implies that teacher are willing to work toward a common set of objectives for the basic curriculum.

The environmetal circumstances are those associated with a centralized (or centralizing) district where a decision to achieve a commonly agreed-upon set of objectives throughout is in operation. In this specific setting, a substantial effort was made to include teachers extensively in the system development and to target reports to assist their instructional monitoring activiti within the district-wide framework. It's too early to tell (the system is less than 2 years old) whether these environmental conditions will lead to a high degree of complience or conflict within the teaching force over time. As the system becomes connected to the state data bases (in planning at present), external influences will perhaps further impact the decision makers' use of information.

Example 2 -- Annual Evaluation Report

Exhibits 4 and 5 are taken from an annual report of standardized test performance on a single school from a large metropolitan school district. Although the report is unclear about the target audience, presumably both the principal and teachers (collectively) are the decision makers in this case. (The report contained other information besides the test scores.)

The displays from this example involve a substantial amount of information (high IM) although the information is more highly summarized than in the earlier example (lower SP). The concern for psychometric properties of the data are also greater (higher PQ).

The most striking distinction from Example 1, however, is the substantially greater demands placed on the decision makers' knowledge base with respect to quantitative information. While

Exhibit 4

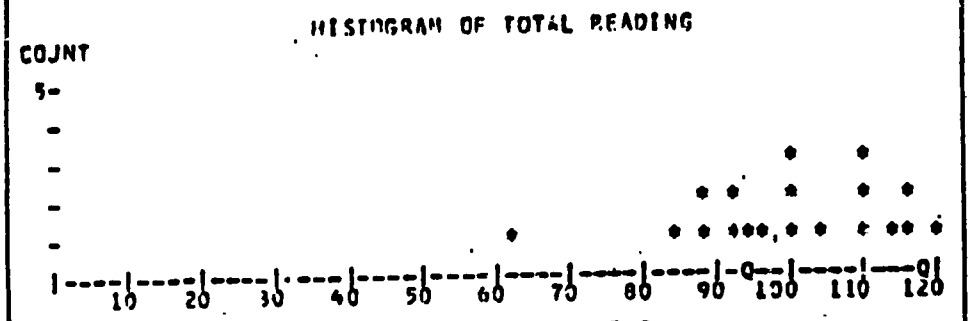
```
                              STUDENT ACHIEVEMENT ON C.T.B.S.
                           MATCHED PRE-POST GRADE EQUIVALENT SCORES
                                     SIP STUDENTS ONLY

 SCHOOL:                                   SUBTEST: TOTAL READING                             YEAR: 1979-80
-------------------------------------------------------------------------------------------------------------------
GRADE |    | PRE  | POST |            G R A D E   E Q U I V A L E N T   V A L U E S                 | YEARS  CHANGE
LEVEL |  N | TEST | TEST |         1         2         3         4         5         6         7         |  PRE TO POST
-------------------------------------------------------------------------------------------------------------------
      |    |  NA  |      |         |         |         |         |         |         |         |         |
  1   | 43 |      |      |         |         |         |         |         |         |         |         |
      |    |      |  1.7 |XXXXXXXXXXXXXXXXX  |         |         |         |         |         |         |
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      |    |  1.7 |      |00000000000000000  |         |         |         |         |         |         |
  2   | 44 |      |      |         |         |         |         |         |         |         |         |      0.4
      |    |      |  2.1 |XXXXXXXXXXXXXXXXXXXXX        |         |         |         |         |         |
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      |    |  2.2 |      |0000000000000000000000       |         |         |         |         |         |
  3   | 54 |      |      |         |         |         |         |         |         |         |         |      1.3
      |    |      |  3.5 |XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX    |         |         |         |         |
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      |    |  3.4 |      |0000000000000000000000000000000000     |         |         |         |         |
  4   | 63 |      |      |         |         |         |         |         |         |         |         |      0.7
      |    |      |  4.1 |XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX        |         |         |         |
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      |    |  4.0 |      |0000000000000000000000000000000000000000         |         |         |         |
  5   | 66 |      |      |         |         |         |         |         |         |         |         |      1.4
      |    |      |  5.4 |XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX     |         |         |
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      |    |  4.7 |      |00000000000000000000000000000000000000000000000  |         |         |         |
  6   | 52 |      |      |         |         |         |         |         |         |         |         |      1.0
      |    |      |  5.7 |XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX  |         |         |
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
THE DATA DISPLAYED ABOVE ARE 'MATCHED DATA.'
ONLY FLUENT ENGLISH SPEAKING STUDENTS WHO TOOK BOTH THE
PRETESTS AND POSTTESTS ARE INCLUDED.
```

Exhibit 5

DISPLAY OF CTBS TEST RESULTS FOR GRADE 1

PRETEST DATA, Spring 1979, CTBS Level A → POSTTEST DATA, Spring 1980, CTBS Level B

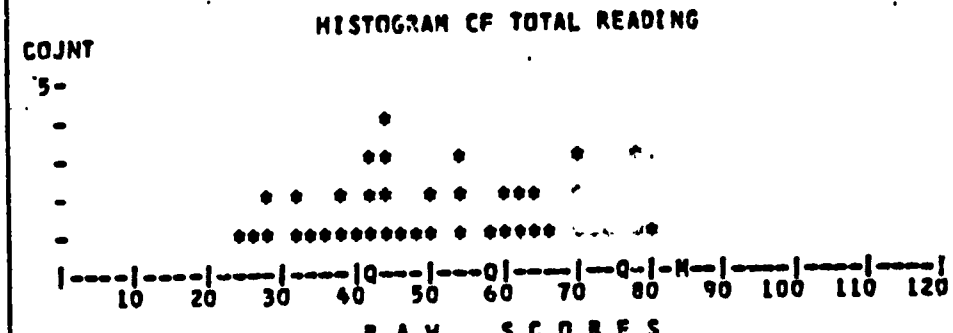


N..... 43
MEAN..... 116.74 MEAN PERCENTILE... 49
MEDIAN..... 122.75 MEDIAN PERCENTILE. 60
STANDARD DEVIATION... 18.69

QUARTILE INFORMATION

N IN Q1 = 07 N IN Q2 = 11 N IN Q3 = 10 N IN Q4 = 15
% IN Q1 = 16 % IN Q2 = 26 % IN Q3 = 23 % IN Q4 = 35

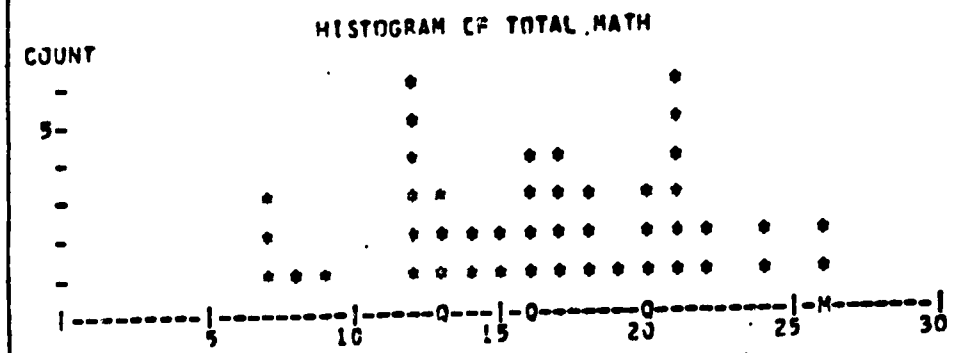
2.5 STUDENTS SCORED ABOVE 120 AND HENCE ARE NOT DISPLAYED ON THE HISTOGRAM ABOVE



N..... 43 MEAN G.E..... 1.7
MEAN..... 52.09 MEAN PERCENTILE... 41
MEDIAN..... 51.00 MEDIAN PERCENTILE. 40
STANDARD DEVIATION... 16.40

QUARTILE INFORMATION

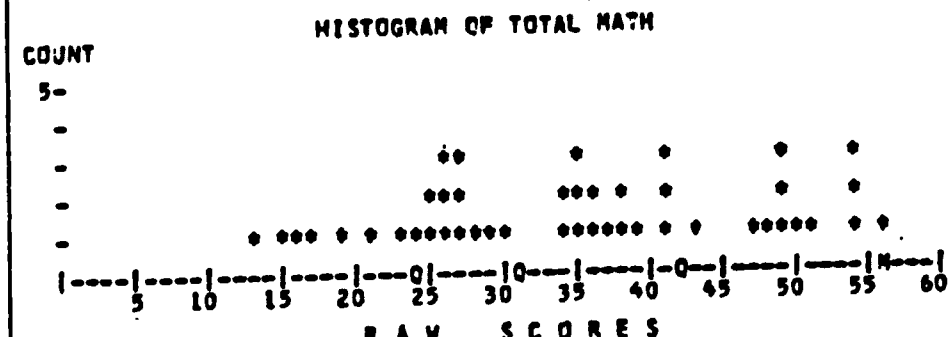
N IN Q1 = 12 N IN Q2 = 14 N IN Q3 = 13 N IN Q4 = 04
% IN Q1 = 28 % IN Q2 = 33 % IN Q3 = 30 % IN Q4 = 09



N..... 45
MEAN..... 16.48 MEAN PERCENTILE... 43
MEDIAN..... 16.62 MEDIAN PERCENTILE. 50
STANDARD DEVIATION... 5.00

QUARTILE INFORMATION

N IN Q1 = 14 N IN Q2 = 08 N IN Q3 = 11 N IN Q4 = 12
% IN Q1 = 31 % IN Q2 = 18 % IN Q3 = 24 % IN Q4 = 27



N..... 45 MEAN G.E..... 1.8
MEAN..... 34.84 MEAN PERCENTILE... 58
MEDIAN..... 35.00 MEDIAN PERCENTILE. 58
STANDARD DEVIATION... 11.82

QUARTILE INFORMATION

N IN Q1 = 08 N IN Q2 = 11 N IN Q3 = 14 N IN Q4 = 12
% IN Q1 = 18 % IN Q2 = 24 % IN Q3 = 31 % IN Q4 = 27

ch "*" represents 1 student(s). Only students who were pretested and posttested are included.

there is virtually no information about subject matter content, the user is presented at least 8 different statistical concepts (grade-equivalent, histogram, mean, median, standard deveation, mean percentile, median percentile, quartile) plus assorted notation ("% in QI") and types of graphic displays. Given the literature on teachers and administrator knowledge about testing and measurement (e.g. Gullickson, 1984a, 1984b; Mayo, 1967; Rudman, et al, 1980) there seems to be a much greater likelihood that the targeted decision makers will be unable to use this information effectively for educational decision making (Alkin and his colleagues (e.g., Alkin et al, 1985; Stecher, Alkin & Flesher, 1981) provide some insight into this apparent mismatch between information and intended user).

Example 3--At-A-Glance Reports

The next set of exhibits are the familiar at-a-glance reports from the Systemic Evaluation Project's case study. The development and implementation of these reports, and the reactions of school personnel to them, are documented and analyzed in other project reports (Burstein & Sirotnik, 1984; Dorr-Bremme, 1984, 1985; Sirotnik & Burstein, 1985). Here we focus on subsets of the questions from the student survey and their reporting and use to illustrate how the decision context influences specificity decisions with respect to non-achievement data.

Of the 14 columns of information on the final version of the student-at-a-glance report (Exhibit 6), 6 columns (educational expectations, academic self-concept, job status, activities, homework, like school) are based on information from the student

CTION:
ACHER:

STUDENTS AT A GLANCE

EXHIBIT C

PREPARED ON 10 OCT 84

UDENT UMBER	STUDENT NAME	GRADE	CH SCHOOL	ED EXPECT	DAYS ABS	CTBS READ	CTBS LANG	CTBS MATH	GPA	ACAD SC	HOMEWORK	JOB	ACTIVITY	LIKE SCH
49043	ADAMS, WILLIAM B	12	.	4Y	.	.	.	.	1.1	H	+	P	3	+
49052	ANDERSON, JOHN I	.	.	HS	.	.	.	.	.	M	+	P	0	+
41950	ATWOOD, DANIEL K	12	6	HS	57	33	14	3	1.9	M	-	H	0	-
49274	BAGLEY, LOIS J	12	3	4Y	35	52	84	83	2.6	M	0	H	2	+
42468	BAKER, MARY M	12	3	2Y	17	34	54	3	1.8	H	+	N	2	+
49341	BUTLER, JOYCE	12	3	2Y	18	49	67	0	2.7	H	+	N	0	+
43686	CALDWELL, THOMAS C	12	4	2Y	11	80	88	80	1.6	M	0	H	0	0
49048	CARTER, MATHEW	12	6	2Y	23	68	72	68	2.9	M	+	N	4	+
42771	CLARK, LARRY F	12	6	HS	30	.	.	3	1.5	H	.	N	0	-
49050	COOK, CHERYL	11	6	?	13	83	86	68	3.0	M	0	P	1	-
43177	COOPER, JANE L	12	6	.	55	36	26	35	1.4	.	.	.	.	.
44197	CURTIS, EDWARD M	12	6	4Y	27	19	7	7	2.1	M	+	P	3	+
49286	DAVIS, LYNN	12	1	4Y	7	66	84	95	3.8	H	+	P	3	+
49288	DUNCAN, JOHN	12	2	4Y	8	87	94	83	3.6	H	+	N	3	+
41828	EATON, TIMOTHY	12	6	2Y	37	10	12	2	.4	M	0	P	0	+
49291	EDERSON, DOROTHY A	12	7	2Y	11	45	62	40	.6	H	-	P	1	+
49069	EVANS, ROBIN S	12	4	2Y	31	41	20	10	.2	M	+	P	0	+
49294	FARMER, DAVID R	12	4	HS	35	.	.	.	2.1	M	+	N	0	-
49295	FELDMAN, ROBERT	12	1	2Y	10	63	64	64	1.7	M	-	P	1	0
49301	FINK, AARON S	12	1	4Y	6	86	96	99	4.1	H	+	P	2	+
49303	HARRIS, CURLEY M	12	6	2Y	35	62	40	83	2.4	M	+	P	2	+
49306	HAYES, CYNTHIA	12	4	2Y	17	1	3	.	2.5	M	-	H	0	-
49167	KAPLAN, HAROLD E	12	5	2Y	27	61	8	32	2.5	M	0	H	0	+
48395	LEWIS, ANTHONY E	.	3	.	43	50	35	35	.	.	.	.	.	.
49168	MARCUS, STANLEY	12	4	4Y	10	83	77	92	3.2	H	+	N	3	+
49309	MC ARTHUR, EUGENE A	12	6	4Y	35	80	70	60	2.8	M	+	H	2	+
49172	MILLER, ELIZABETH	12	3	2Y	46	23	30	28	1.6	M	+	N	0	0
43336	MOORE, OSCAR J	12	2	2Y	32	78	50	3	2.9	M	+	P	0	-
49129	PACE, DONALD W	12	2	2Y	30	16	28	45	1.6	M	-	N	1	-
42520	BANDLE, ANN	12	6	4Y	47	.	.	.	2.1	M	+	P	0	0
42793	ROBERTSON, SHEILA	12	6	4Y	30	99	74	43	2.5	M	+	P	0	+
43660	ROSS, RICHARD E	12	5	HS	45	.	.	.	.8	M	-	P	.	0
43179	SANDERS, JOAN N	12	8	.	118	8	0	37	1.1	.	.	.	.	.
49323	SCOTT, MARION J	12	5	2Y	27	47	45	31	2.1	M	+	P	0	+
49109	SILVERMAN, ARTHUR	12	4	HS	10	61	74	26	1.9	M	-	H	0	+
41481	SNYDER, EVELYN G	12	5	4Y	15	42	17	23	1.3	H	+	M	3	-
44147	STERN, BRUCE D	12	6	2Y	56	54	73	40	2.9	H	+	P	2	+
49262	STUART, DONNA	12	1	2Y	31	92	52	95	3.1	H	+	P	0	-
49329	THOMPSON, WENDY L	12	8	2Y	27	63	50	60	3.0	M	+	H	1	-
43580	WALKER, VICKI S	12	4	2Y	25	12	12	23	2.2	M	-	P	1	-

= MISSING

SCHOOL: CAREER MAGNET SCHOOL.
1=PHYSICAL SCIENCE AND TECHNOLOGY
2=INTERNATIONAL RELATIONS & POLITICAL SCIENCE
3=BUSINESS 4=INDUSTRY 5=PERFORMING VISUAL AND FINE ARTS
6=MENTAL, PHYSICAL & BIOLOGICAL SCIENCES 7=LIBERAL ARTS
8=ENTRY AND ESSENTIALS 9=DONT KNOW

EXPECT: EDUCATIONAL EXPECTATION.
QU=QUIT HIGH SCHOOL HS=FINISH HIGH SCHOOL
2Y=GO TO TRADE/TECHNIC SCHOOL OR JUNIOR COLLEGE
4Y=GO TO 4-YEAR UNIVERSITY ?=DONT KNOW

YS ABS: NUMBER OF FULL DAYS ABSENT.

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BS TEST RESULTS ARE REPORTED IN PERCENTILE RANK.

CAD SC: ACADEMIC SELF CONCEPT. H=HIGH M=MEDIUM L=LOW

CHEWORK: +=ALL/MOST OF THE TIME 0=SOMETIME -=SELDOM/NEVER

OB: F=FULLTIME(30+) H=HALFTIME(20-30) P=PARTTIME(10-20) N=NONE

CTI: NUMBER OF EXTRACURRICULAR ACTIVITIES(1-5).

KE: LIKE OF SCHOOL. +=LIKE 0=NOT SURE -=DISLIKE

survey. While all of the information is reported for each student (i.e., no summarization across students), 4 measures (educational expectations, job, homework, like school) are more or less direct reproductions of students' actual responses while the remaining two are summarizations across a set of questions answered by the students (Exhibit 7 provides the questions and response frequencies that contribute to the student-at-a-glance report).

The rationale behind the selection of these items from the student survey to provide on the class roster-like at-a-glance report and the different degrees of specificity in the reporting are derived from the intended decision context. The pertinent attributes of the context are that the reports were intended to be distributed to secondary school teachers early in the semester to assist in teacher instructional planning (e.g., Are the amount and difficulty of reading material and assignments appropriate for the class? Are special motivational efforts necessary with this class?). Some persons involved in the design of the report (certain teachers from the work group) also believed that the information could be used throughout the semester to help teachers interpret student performance during the class (e.g., Does the student have too many competing committments? Is there a history of performance or behavior problems that could account for an individual's class performance?).

The decision context then is one where teachers are expected to integrate the information according to their own needs rather than rely on externally designed summarizations. The only instances of advance summarization are for the measurement of a

Exhibit 7

Questions) and accompaning frequencies from Spring 1984) used in generating Students-At-A-Glance reports for Site A.

Education Expectations

8. Actually, I will probably:

1 F. Quit school as soon as possible.
23 G. Finish high school.
30 H. Go to trade/technical school or junior college.
40 J. Go to a 4-year college or university.
6 K. Don't know.

Academic Self-Concept (rounded average of 9 questions, scale reviesed on questions 15, 21, and 22)

15. I'm not doing as well as I'd like to in school.	36	32	5	14	12
16. I am a good reader.	39	37	11	8	5
17. I'm proud of my schoolwork.	16	37	17	19	11
18. I'm good at math.	22	33	14	17	14
19. I'm doing the best work that I can.	14	28	13	28	16
20. I am able to do schoolwork at least as well as other students.	46	32	14	6	2
21. My grades are not good enough.	27	32	8	18	15
22. I'm always making mistakes in my schoolwork.	5	16	16	40	23
23. I am a good writer.	21	38	21	14	7

Homework

102. In general, how often do you do your homework?

21 F. All of the time
41 G. Most of the time
21 H. Sometimes
11 J. Seldom
3 K. Never

Job

4. About how many hours a week do you usually spend working on a job during the school year?

50 F. None. I am not employed during the school year.
14 G. About 10 hours or less
18 H. About 15 - 20 hours
13 J. About 20 - 30 hours
6 K. More than 30 hours

Activities (number of yes responses to 5 questions)

	Yes	No
39. I participate in sports teams/drill team/flags/cheerleading.	37	60
40. I participate in student government.	8	88
41. I participate in music, band, drama, or other arts.	17	79
42. I participate in honor society.	19	77
43. I participate in school clubs/community service activities.	26	71

Like School

	Strongly Agree	Mildly Agree	Not Sure	Mildly Disagree	Strongly Disagree
74. I like school.	19	41	14	12	12

general construct (academic self concept) where the individual questions are of limited interest for the teachers and would overemphasize minor fluctuations in student responses to items of this type and a set of items characterizing specific activities where again the general tendency rather than specifics were believed to be pertinent.

The design of the at-a-glance report also reflects the work group's perspective with respect to mass of information and psychometric quality. While the information provided on all class members is quite detailed, the report itself was constrained by the amount of information that could be printed on a single sheet for each class. Many other pieces of information contained in the student survey or available through other sources within the district were not included to keep the data base for decision making manageable for teachers whose time is limited.

The question of psychometric quality was seemingly resolved by accepting the fallible properties of specific questions but assuming that decision making would be based on the "patterns" evident in the responses. Thus the balance and representativeness of the responses was viewed as a means to offset overreliance on specific pieces of flawed information.

The assumptions about the decision maker's knowledge base implicit in the report also warrant mention. First, there is again only a limited amount of numerical reporting; only test scores (percentiles) and g.p.a. involve any statistical summarization to speak of and both are reported in units generally familiar to teachers. Second, the types of information

selected for inclusion in the report suggests that teachers lack basic information about the backgrounds (prior performance, activities, interests) of the students in their classes. Moreover, if teachers had such information, they would use it (and know how to use it) in instructional planning and student monitoring.

The evidence from the report use survey and teacher interviews (See Dorr-Bremme (1985) and Sirotnik & Burstein (1985) for details and extended discussion of these information sources.) is that teachers had mixed reactions to the reports. While many indicated that they found the report informative, some teachers were uninterested in student backgrounds as a basis for course planning. Others worried about the expectations that knowledge of this information would create. Thus there were clear indications of individual differences within the educational setting with respect to perceptions of roles and responsibilities, and presumably with respect to beliefs about teaching. Under such circumstances the system could not be expected to be uniformly valuable to all teachers. In fact one of the strong signals from the use questionnaire results is that secondary teachers are a diverse bunch whose information needs could best be served by a customized information system where the teacher selects from an available menu of data.

Environmental conditions were important in this case as well.(Dorr-Bremme, 1984,1985). Without a committment from the district to participation in the project, without a technically proficient, flexible data processing division, and without a

prior interest within the school in improving educational decision making, the development effort could not have been carried out in the first place. Of more particular interest to the specificity of information reported from the student survey, there was already precedent within the school for maintaining highly detailed and personal information about students in a computerized system developed for school counselors. In fact certain teachers already were accessing these files. Thus there was an atmosphere established where it was not unreasonable to ask students personal questions and to share their responses with the teaching staff. Later concerns were expressed about the lack of anonymity of student data another indication of diversity of beliefs and perspectives among the targeted decision makers. This mixed reaction also was symptomatic of the environmental circumstances under which the system was developed and poses a dilemma for its sustainability.

Concluding Comments

We could continue to present illustrations from other information system settings of the applicability of the components of our rudimentary model of human decision making to the decisions about the specificity of information to include. Ideally, one would like to see a taxonomy of decision contexts (including types of decisions, types of data, and types of decision maker) developed that indicated how the various attributes from the decision making model influence the appropriate specificity of information as well as other characteristics of the information system. Unfortunately, such a taxonomy could quickly become encyclopedic. A more modest goal

would be to establish the value of considering a few key concepts from the psychology of human decision making as a routine part of the development of instructional information systems.

As researchers and practitioners go about "inventing the future" of information systems for data-based decision making in schools, there will continue to be fits and starts, small successes and maybe big failures which will have to be understood and explained to sustain real progress. Explanations for accomplishments, and lack thereof, in different educational settings will continue to rely heavily on the kinds of social organizational, political, and historical reasoning that is reflected throughout the reports and articles generated by both the Systemic Evaluation Project and the Management of Instructional Information Systems Project (refer to the reports already cited throughout this paper). This paper is intended as a small reminder that psychological explanations, especially those derived from models of human decision making, are pertinent as well.

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