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ABSTRACT

The Computing Potential in Atlanta Public School Education (CPAPSE) was developed to determine teacher attitudes about computing potential as an instructional tool and to compare current practice with potential computing applications to determine the degree to which computer resources are being used in grades 2, 3, and 4. During the last week of school for the 1989-90 year, 472 teachers from 62 Atlanta (Georgia) Public School System elementary schools answered questions about perceived skills, cognitive proficiencies, present practices, and current and potential matches between computing and subject area. Univariate statistics are reported for data reduced to one-tenth of the scales answered by teachers and normed to five points of their cumulative distribution functions. The second analytic stage computed factors for the 39 unified item scale and for 5 scales representing logical divisions of items. A second-order factor analysis is reported for the 11 first-order factors arising from factoring scales for 5 CPAPSE parts. A three-factor construct validation is presented for the CPAPSE. Multivariate analyses of variance showed that for all significant grade level differences there were systematic transitions of factor score means from second through third to fourth levels of instruction. Five figures and 12 tables present analysis results. Appendix A contains the 40-item survey, and Appendix B contains teacher comments and item-by-item responses for coded respondents. (SLD)

REPORT NUMBER 2: COMPUTING POTENTIAL ASSESSMENT IN ATLANTA PUBLIC SCHOOLS EDUCATION

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The basis for this article was Revision Number 1 of Report Number 1: OBSERVATION SCHEDULE FOR COMPUTERS IN THE CLASSROOM ENVIRONMENT to Atlanta Public Schools, dated September 17, 1990

ABSTRACT

This study was undertaken to develop a sense of the broad curricular implications of one external element (computing with software as an instructional tool) on the instructional environment in elementary classrooms of the Atlanta Public School System. An instrument was developed (Computing Potential in Atlanta Public School Education) to support assessment of the current pulse of teacher self-disclosure concerning computing potential as an instructional tool. The instrument further was used to examine resource functionality comparing current practice with potential computing applications in an effort better to define the relative degree to which computer resources were being assimilated at the 2nd, 3rd, and 4th grade levels. The concluding section of the report presents a vision of boundaries within which future plans are recommended as a function of present teacher perceptions of both computing practice and its potential. From assessment of the level of present practice (including a sampling of perceptions of use of software), of some teacher interactions with equipment, and of general linkages between technology and instruction, recommendations were provided for computing as an instructional tool at the level of two specific subject areas, science and social studies. It was reasoned that teacher self disclosures on perceived skill levels, cognitive proficiencies, present practices, and current and potential matches between computing and school subject areas would establish the classroom instruction dimension for continuing the present study and embarking on related subsequent studies. A sample of 472 volunteer respondents represented 62 of 83 elementary schools in the system. A series of univariate statistics were undertaken and reported for data reduced to 1/10 of the scales responded to by the teachers and normed to 5 points of their cumulative distribution functions. The second analytic stage computed factors for the 39 unified item scale and for 5 scales representing logical divisions of items. A second order factor

analysis is reported for the 11 first order factors arising from factoring of scales for the 5 instrument parts. A three factor construct validation (with factors named Ability/Applications, Deficiencies, and Negative/Traditional) for the instrument is presented. Finally, factor scores from the factor analytic stage were subjected to MANOVA with Teacher Grade Level as an independent variable with the finding of significant differences among the location centroids for each analysis. For all significant Grade Level differences there were systematic transitions of factor score means from second through third to fourth levels of instruction.

COMPUTING POTENTIAL IN ATLANTA PUBLIC SCHOOL EDUCATION

Enabling policy coupled with adequate funding have fostered implementation of computing in Atlanta Public Schools (APS), particularly at the second, third, and fourth grade levels. Computer availability; its existence for three years for current (1989-90) fourth graders, two years for third graders, and one year for second graders; and the need for contractual monitoring with Jostens Learning Corporation (JLC) have sparked renewed administrator and board interest and enthusiasm for computers as educational tools in APS. Not unexpectedly, widespread change as undertaken in the last three years may be controversial at the faculty level and may have raised a wide variety of faculty expectations about actual, as well as potential, educational uses of computing technology. These are elements needing definition for a variety of interests, particularly for those interested in public school accountability, achievement, equity of access, and management of resources.

Need for the Study

In a wider context, APS currently is at the stage delineated by Baum (1987) as the second stage (for a Colorado School District) for continuous updating of broad curricular implications of external elements on the instructional environment. APS has involved an evaluator (the writer of this report) to evaluate/audit one of the processes (computing) involved in the development of district-wide goals. One purpose of the evaluation is to assess the current pulse of teacher awareness to the potential for computing as an instructional tool. Being at the second stage, the need existed to collect viewpoints about the existing- and desired-program. With completion of this report, furthermore, APS will have exited from Baum's third stage through having analyzed,

to some degree, its existing program, and will have entered Baum's fourth stage by comparing the existing with the potential programs as defined by teacher perceptions.

There is no reason to expect that the findings of Kulik (1983) would not be applicable in the current APS setting: "A meta-analysis of 51 studies of computer-based instruction shows: a rise in student test scores; student attitudes toward the subject that are slightly more favorable; student attitudes toward computers that are strikingly more positive; and savings from 39 percent to 88 percent in student learning time." What is needed are data with which similar expectations may be evaluated, at least in part, at the current stage of expansion and implementation of the JLC contract with the APS system.

Buttram and others (1986) in a 160 page report for a cooperative project between the New Jersey School Boards Association (Trenton) and Research for Better Schools, Inc., (Philadelphia, Pa) described a process for eliciting, organizing, and judging information descriptive of school district practices. Significantly, influences of district practices on student achievement were noted with a definition of standards for assessing district effectiveness. At the LISREL phase of the current project influences of JLC computing on student achievement are intended measurement purposes. For the current phase, a background for those influences was desired. That background, in the context of the typology developed by Cargill (1987) and of current activities reported in the following, may be typed loosely as a combination of operations, performance, and special review.

Dierdorff (1989) suggested performance auditing to be a tool for assisting public officials with efficient and effective application of resources. One purpose motivating the current study was to examine resource functionality comparing current practice with potential computing

applications in an effort better to define the relative degree to which computer resources were being assimilated at the second, third, and fourth grade levels in the Atlanta Public Schools.

Moreover, Collis (Assessment, 1989), in a paper presented in Belgium, provided powerful reasons for evaluating use of computers in schools. Among those reasons were that evaluation potentially contributes to the validation process by providing a base of information from which subsequent change or growth may be reliably charted. Evaluation can provide generalizable data which may facilitate the implementation of computing projects in other grade levels, thereby (perhaps) reducing waste of time and money, an important consideration given usual public demand for accountability in education.

Jeger and Slotnik (1985) reporting for the New York Institute of Technology (Old Westbury) under sponsorship of the Department of Education (Washington, DC) described a multi-paradigmatic approach for evaluating implementation of CAI in higher education for English and mathematics. Jeger and Slotnik considered both qualitative and quantitative methods for assessing changes in practice related to instructional effectiveness. Earlier, Hazen (1980) also suggested multiple methods to have distinct advantages over a single method for evaluating CAI and CMI instruction. The current study utilizes multiple methods: an environmental analysis with an observation schedule, this analysis providing measures of computing potential, and the final LISREL method for fitting together the foregoing with all the other related parts for delineating influences on achievement of firmly specified 1989-90 objectives formulated by the Atlanta School Board. The current project considers both qualitative (with the Observation Schedule) and quasi-quantitative (with the Computing Potential instrument) methods at the elementary school level. One component in the current project was development of an

instrument formally titled as "Computing Potential in Atlanta Public School Education" (hereafter referred to simply as the Computing Potential Instrument).

Reporting on educational computing issues in Alberta (Canada), Thiessen (1984) described elements parallel to this APS study of technology in instruction including needed support for short- and long-range planning for educational computing activities. To define parameters for plans, the planner, of necessity, needs to have some boundaries within which the plans must fit. Those boundaries should relate to the visions held by implementers of the plans for future possibilities. The ultimate implementers of computing technology in elementary school instruction in the APS case would be the teachers, and their vision of boundaries would certainly be a function of their present perceptions of both computing practice and its potential in Atlanta Public Schools.

Wilson and McGrail (1987) representing Research for Better Schools, Inc. (Philadelphia, Pa.), claimed school climate to be a powerful, complicated concept needing consideration in the research process. Fundamental to its definition are both choice of related variables and methods for data gathering and reporting. Wilson and McGrail held that one reason to collect school climate data was to evaluate school programs. In the APS case, it was judged that how teachers viewed computing potential in APS would be a climatic determiner into which the educational environment for computing would need to be set both to interpret the findings and to draw conclusions concerning the contribution of computing to student achievement of APS Objectives.

Purpose of the Study

The study to which this report applies was undertaken, under stimulus of the foregoing, to measure second, third, and fourth grade teachers' perceptions of computing practices and

potentials in the Atlanta Public School System. Since proficiency often is a determiner of practice, the first specific purpose was to measure perceptions of levels of skill proficiency with software (e.g., BankStreet Writer) and cognitive proficiency in theoretical areas relating computing to instructional methodology (e.g., how computer peripherals work).

The second purpose was to assess the level of present practice in utilization of computing technology in the instructional process. Here, it was desired to sample perceptions of use of software, of some teacher interactions with equipment, and of general linkages between technology and instruction. A final purpose was to assess current and potential practices for relating computing as a teaching tool to instruction at the level of specific subject areas in Atlanta Public Schools.

Context from the Literature

The Computing Potential Instrument was meant to survey second, third, and fourth grade APS teachers in a manner somewhat parallel to the importance-performance analysis of Alberty and Mihalik (1989). Doing so was intended to provide further data on classroom environments beyond that obtained with the Observation Schedule (1990). From both instruments one should obtain data at least loosely related to instructional effectiveness. Both types of data should contribute to understanding of student achievement of systemwide objectives.

Burstein and others (1977, Winter) audited the California Early Childhood Education Program on behalf of the California State Department of Education reporting on information utilization and program evaluation. The methods and procedures for the current study were undertaken and are described under the next major division of this report in a manner intended to expedite evaluating two of the same areas audited for the Burnstein document: (a) overall

data management and processing, and (b) information quality for the evaluation of program impact.

Bostrom and others (1982) from the University of Leeds (England) under sponsorship of the Social Science Research Council of London evaluated microcomputing in schools of Great Britain. Teachers' opinions and judgments were collected using interviews and questionnaires (classroom observation schedules, pupil questionnaires, and teacher interviews).

The Southeastern Regional Council for Educational Improvement, Research Triangle Park, N.C. (1984) under sponsorship of The National Institute of Education (Washington, DC), considered computing in classroom environments. In an interpretive report of the resulting conference the council discussed transcending current educational limits of the present system through innovations in instructional practices and redefinitions of skills needed for a technological age. The fourth section of that report concerned realization of the potential of technology in schools suggesting its dependence on teacher competencies as well as on quality of software and networking.

Herman (1985), representing the Center for the Study of Evaluation (CSE) at California University (Los Angeles) under sponsorship of the National Institute of Education (Washington, DC), wrote that researchers conducting evaluations of educational programs need to consider program goals and objectives in measurement of program implementation. As will be pointed out in more detail below, stated JLC objectives were incorporated in developing the Computing Potential Instrument.

Stoneberg (1985), reporting to the board of Greater Albany (Oregon) Public School District 8J, for an evaluation of computer assisted instruction in mathematics, explored student,

parent, and staff attitudes toward the WICAT System 300 in one elementary school. The major Stoneberg (1985) findings ". . . indicated that achievement scores improved significantly--with the most dramatic improvements among students in the second grade--and that students, parents, and staff gave high ratings to CAI."

Lewis (1985) in the Department of Psychology, a component of the Economic and Social Research Council at Lancaster University (England) wrote a report concerning research priorities under the information technology and education programme (ITE) in the United Kingdom. Lewis suggested a role for teachers in clarification of the meaning of instructional technology literacy, and suggested a need for evaluation of instructional technology techniques in educational programs of the United Kingdom. The current APS study was commissioned under similar objectives.

Representing Research for Better Schools, Inc. (Philadelphia, Pa.), under sponsorship of the National Institute of Education (Washington, DC), Wilson (1984) claimed nine key organizational dimensions from the literature that needed understanding for adequate assessment. One key organizational dimension from the nine, for understanding in the present study, is the dimension of classroom instruction. The facet of the classroom needing direct focus is the facet clarifying observed variations in level of student usage. It was reasoned that teacher self disclosures on perceived skill levels, cognitive proficiencies, present practices, and current and potential matches between computing and school subject areas would establish the classroom instruction dimension for the present and subsequent studies.

Winkler and others (1985) clarified interpretation of the idea of classroom instruction with their argument that pedagogically sound use of classroom microcomputers should be

interpreted under the perspective of teacher instructional goals, and curricula and microcomputer-based learning activities. Measurement with the Computing Potential Instrument assisted in defining implementation of goals raised by JLC rather than by teachers and set the stage for understanding microcomputer-based learning activities.

METHODS AND PROCEDURES

JLC Goals

The current study was meant to be an exploratory study of current and potential computer utilization in APS classrooms, each classroom having 3 computers as common fixtures. It was based on an instrument currently known as "The Computing Potential Instrument" created, in part, from externally defined Jostens Learning Corporation (JLC) Teacher Proficiencies. A memorandum from Cindy Owens/Carolyn Spears of Jostens Learning Corporation sent to Tracy Faulkner/Dr. Cobbs of Atlanta Public Schools on October 6, 1989 was the starting point in developing content for "Computing Potential in Atlanta Public School Education" (the Computing Potential instrument) included as Appendix A. That memorandum listed Teacher Proficiencies that should characterize all APS teachers at the end of a training session they attended prior to the 89-90 academic year. The seminar was conducted by JLC staff. According to JLC, the teachers, having had such a seminar, would be able to:

1. Use several word processors, Bankstreet Writer and Children's Writing/Publishing.
2. Have a strong working knowledge of the computer and its parts.
3. Have an understanding of a local area network and how it functions.

4. Better understand the writing process.
5. Schedule use of technology throughout the instructional day.
6. Use the technology each day in every subject.
7. Use software in conjunction with basal texts.
8. Use software to enhance the reading, writing, math and language arts skills of students.
9. Trouble shoot minor computer problems.
10. Utilize whole language approach to teaching, writing and reading.
11. Use computer to teach science simulations.
12. Increase personal writing skills.
13. Use innovative teaching methods in reading, math, science, social studies, language arts and writing.
14. Systematically incorporate use of classroom resources.
15. Use text and graphic software to enhance children's writing skills.

The Computing Potential Instrument was intended to measure items related to the explicit purposes of the study. Items on the preceding list were closely related to the purposes. Therefore, some of the items (as possible) were measured directly and others were measured as surrogate items. Descriptive analyses of variables were undertaken and reported as findings to allow probability statements for instructional utilization and compliance. With such data the subsequent LISREL phase of the study should allow for exploration of the effects on systemwide objectives of computing technology from limited teacher self-reporting.

The Computing Potential Instrument underwent a number of revisions. The first draft was intended to capture purposes already described. That draft was balanced against the JLC statements of Teacher Proficiencies noted earlier. Research Associates from the Atlanta Public School System then participated in two revisions through reviewing the instrument during two of its scheduled meetings. Finally, revisions were undertaken in response to private reviews by two Research Associates individually.

Data were collected from teachers during the final week of school for the 1989-90 academic year. Instruments were delivered to all 83 elementary schools by their respective research associates. An agenda item in one of the last faculty meetings of the academic year in each elementary school was administration of the instrument. Completed instruments were returned to the Superintendent's Office prior to being entered on answer sheets from which a data set was developed. The data were entered onto answer sheets and verified, and the answer sheets were scanned into EBCDIC data sets by personnel in the APS Computer Center. The EBCDIC version was downloaded in ASCII format to a micro-disk. Each line of the ASCII data set was then visually verified against the original answers of the teachers from the Computing Potential response sheets.

There was no attempt either to use intact, or to adapt, an existing instrument to measure computing potential. This decision was taken for two reasons: (a) the situation was unique in that the curriculum was tied to contracts with JLC, and (2) if a Likert-type instrument aligned with JLC objectives could have been found there was no certainty that it would satisfy essential assumptions or have satisfactory levels of validity and reliability in the APS context (Bardo, 1976).

Authority from Selected Literature

McCombs and Dobrovolny (1980) representing McDonnell Douglas Astronautics Co. (East St. Louis, MO) under sponsorship of the Navy Personnel Research and Development Center (San Diego, CA) found that at the level of postsecondary education, a systems engineering analysis approach can be used to identify computer-based functions that directly support student learning in a CMI environment. The Computing Potential questionnaire was constructed to measure functions determined in much the same way by analyzing the system from which (and for which) data were collected. That system earlier has been acknowledged as the instructional system implicit in the APS-JLC contract.

Anderson (1984) discussed the influence of Evaluation Research Society (ERS) Standards on practicing program evaluators noting that careful adherence to the standards often requires resources and evaluator skills beyond those ordinarily available. Procedures and processes contained in this APS report address, at a level deemed appropriate by the evaluator/writer, the issues raised by Anderson concerning description of choice options, ethical considerations, and context, costs, and controls.

Coe (1985), writing for the Northwest Regional Educational Laboratory (Portland, Oregon), under sponsorship of the National Institute of Education (Washington, DC), developed a checklist for assessing level of computer use in school districts as well as for monitoring implementation of progress of on-going programs. The Computing Potential Instrument is more than a checklist in that it records for each item perceptions beyond the presence-absence dichotomy, allowing instead recording on a rough continuous scale between 00 and 100. Because of imprecision in the scale, values for analysis were reduced tenfold to a scale of 1

through 10, a scale of about the same resolution as the resolution with which a teacher was believed able to record self perceptions. It was assumed that the reduced scale had properties adequate for analyses based on robust computations. Properties were assumed at the level of data investigated by Kenny (1986) who concluded that rating scales commonly used in evaluation research appear to possess metric properties ordinarily associated with interval scales.

Others (e.g., Loyd and Loyd, 1985) have examined teacher attitudes toward microcomputers using similar methodologies: (a) reliability, (b) factorial validity, and (c) differential validities of computer attitude scales and their subscales. While perceptions are not attitudes, they have enough in common to justify similar statistical procedures. The rescaled data thus were subjected to SPSS-PC analyses yielding direct computation of reliabilities and investigation of factorial validities for each computed scale. Out of these techniques one could compare subscale with scale validities.

However, the design of the current project was neither as comprehensive nor as ambitious as other recent studies. Morton and Beverly (1988) provided a model process for evaluation of instructional computer use by school districts. In addition to evaluating current activities their manual focused on development of goals and objectives and on forecasting long term uses for instructional technology. The Computing Potential Instrument was constructed to measure and evaluate goals already formulated.

"The Standards" for evaluation of educational programs were not applied in designing the present study nor were their effects evaluated during the process as was done recently for the Payne (1988) evaluation of PLATO in an Atlanta High School. On the other hand, no

standard was intentionally violated. In fact, none are known to have been violated, either intentionally or unintentionally.

Delimitations

The current study of necessity was delimited in not comprehensively considering research relevant to teacher innovations and barriers to change needed (as noted by Lewis, 1985) as a result of instructional technology in APS. There was no attempt to measure teacher perceptions of support needed for more complete use of the JLC system, or for assisting APS students with transcending traditional curriculum barriers or overcoming arbitrary, traditional, instructional delimitations influencing the potential of computing in Atlanta Public Schools.

FINDINGS

The findings are presented in this section in essentially the same sequence they were developed. No records were kept concerning mis-codings discovered in the verification processes of teacher response data against the coded data. A series of univariate statistics were undertaken and reported for data reduced to 1/10 of the scales responded to by the teachers. The second analytic stage computed factors for the 39 item scale and for scales representing logical divisions of items. Finally, factor scores from the factor analytic stage were subjected to MANOVA with GRADE level as an independent variable.

Univariate Statistics

Demographic Variables. Because it was not required that every teacher respond to the Computing Potential Instrument, it was deemed desirable to collect at least a minimum amount of data to examine representativeness of the sample for the population of second, third, and

fourth grade teachers in the Atlanta Public School System. Table 1 shows that 62 schools of 83 were represented. In addition, there were 7 instruments without a school designation and another that probably was from Gideons. While it is unfortunate that not every school was represented, it was not possible to enter a second phase of data collection because of lateness in the academic year for data collection.

Table 1

Frequencies of Observations in Elementary Schools in Ascending Order of School Codes

Elementary School	School Code	Frequency	Percent	Elementary School	School Code	Frequency	Percent
MISSING	0	7	1.5	Guice	42364	8	1.7
Adamsville	41007	8	1.7	Howard	42427	7	1.5
Arkwright	41028	5	1.1	Hubert	42434	6	1.3
Beecher Hills	41042	5	1.1	Humphries	42441	7	1.5
Capital View	41133	2	.4	Kirkwood	42504	6	1.3
Cascade	41161	6	1.3	Lakewood	42511	6	1.3
Collier Heights	41203	11	2.3	Lin	42518	7	1.5
Connally	41210	12	2.5	McGill	42532	5	1.1
Continental Colony	41217	11	2.3	Peterson	42616	7	1.5
Dunbar	41259	8	1.7	Slater	42700	11	2.3
Fain	41287	5	1.1	Slaton	42707	9	1.9
Gideons	41329	14	3.0	Stanton, D. H.	42734	10	2.1
	31329	1	.2	Toomer	42784	7	1.5
Harwell	41392	7	1.5	Waters	42833	10	2.1
Hutchinson	41448	9	1.9	West	42841	9	1.9
Kimberly	41490	11	2.3	Whitefoord	42875	8	1.7
Miles	41539	4	.8	Bethune	43063	5	1.1
Perkerson	41609	7	1.5	Boyd	43084	7	1.5
Peyton Forest	41623	10	2.1	Brandon	43091	7	1.5
Ragsdale	41658	7	1.5	Carey	43140	6	1.3
Sylvan Hills	41868	8	1.7	Cook	43224	6	1.3
Venetian	41805	13	2.8	English Avenue	43280	6	1.3
West Atlanta	41847	3	.6	Garden Hills	43315	8	1.7
West Manor	41861	6	1.3	Grove Park	43357	13	2.8
White	41868	7	1.5	Hill	43406	1	.2
Wright	41896	4	.8	Jones, M. A.	43476	7	1.5
Bentoen	42056	2	.4	Mitchell	43546	6	1.3
Blair Village	42070	3	.6	Morningside	43560	10	2.1
Burgess	42119	5	1.1	Oglethorpe	43588	3	.6
Cleveland	42189	2	.4	Scott	43693	7	1.5
Dobbs	42238	7	1.5	Smith	43721	3	.6
Drew	42252	13	2.8	Towns	43791	6	1.3
East Lake	42273	8	1.7	Woodson	43889	9	1.9
Gordon	42336	8	1.7				
					Total:	472	100.0
Valid Cases: 465				Missing Cases: 7			

From Table 2, one observes that there was not an even split in responses for either grade levels represented or sections. A number of respondees did not provide either type of data. The Grade 5 respondee may represent a teacher assigned to a fourth-fifth grade who elected to reveal

only the fifth grade affiliation. Similarly, the two Grade 1 responses may have arisen from respondents assigned to two grade levels.

Table 2

Frequencies for Observations by Grade Level and by Section

Grade	Frequency	Percent	Section	Frequency	Percent
0	11	2.3	0	34	7.2
1	2	.4	1	127	26.9
2	168	35.6	2	151	32.0
3	153	32.4	3	99	21.0
4	137	29.0	4	41	8.7
5	1	.2	5	18	3.8
			6	2	.4
Valid Cases:	**461**		**Total:**	**472**	**100.0**
Missing Cases:	**11**		**Valid Cases:**	**438**	
			Missing Cases:	**34**	

Computing Potential Items. For all items, a non-response was taken as equivalent to a zero response communicating the worst situation (no skill at all for the Part I items). Across the page of each distribution table in the presentation there are two items associated with the same part of the instrument and stubbed in common from the scaled value equivalents presented on the instrument. For example, Items 1 and 2 have a common set of stubbed values at the left margin, so do Items 3 and 4, and so forth through all the item distribution tables. Close to the bottom of the table area are scaled values associated with the 10th, 25th, 50th, 75th, and 90th percentiles.

The headings for each item contain the item number and a close approximation of its statement from the instrument. A spanner under each item indicates the nature of the

information in each column: Val represents response value, Freq represents the number of teachers selecting the response value on the same line, % indicates the percentage the observed frequency to its left is of the total number of respondents (n=2), and Cum % contains values for the cumulative sum of all percentages up to and including the percentage on the same line.

There is a connection between cumulative percentages and percentiles. The percentile values are, in fact, in correspondence with cumulative percentages. There is, therefore, a measure of redundancy built into each table — if the reader wishes information corresponding to the item response values, interest would be in the vertical columns of numbers under the spanner for each item; if the reader wishes information for areas under the frequency distribution at the five percentiles noted, interest would be in the horizontal percentile component/segment.

Table 3 presents frequency distribution data for the 11, Part I Items labeled on the Computing Potential Instrument to represent levels of skill proficiencies. Table 4 contains response data for the 4, Part II Items concerned with levels of cognitive proficiency. Table 5 reflects frequency distribution data for levels of present practice. Tables 6 and 7 pertain to judgments of general CURRENT and POTENTIAL match between subjects and computers with software as teaching tools.

A cursory examination of the tables provides some evidence for the statement that there was variability in responses both between items and within items. There is no generalization for describing the findings across all items: some items were skewed positively, some were skewed negatively, and some were nicely mound-shaped toward the center of the distribution; some items were somewhat rectangular (platykurtic); and some centered closely around one or

two values (leptokurtic). The distributions differ enough from normality to demand care in selection of further statistical methods.

Table 3

Distributions for Response Values of Part I ÷ 10 (Items 1-11)

Item Number/Label	01: I Can Use BankStreet Writer.				02: I Can Use Children's Writing/Publishing.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
Not At All	0	14	3.0	3.0	0	48	10.2	10.2
With Help of Another	1	11	2.3	5.3	1	9	1.9	12.1
	2	29	6.1	11.4	2	34	7.2	19.3
On-Screen Tutorial Plus	3	11	2.3	13.8	3	4	.8	20.1
Manual	4	16	3.4	17.2	4	19	4.0	24.2
	5	29	6.1	23.3	5	47	10.0	34.1
With On-Screen Tutorial	6	18	3.8	27.1	6	15	3.2	37.3
Alone	7	35	7.4	34.5	7	33	7.0	44.3
	8	84	17.8	52.3	8	97	20.6	64.8
Easily From Memory	9	121	25.6	78.0	9	93	19.7	84.5
	10	104	22.0	100.0	10	73	15.5	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 2 6 8 9 10				Value: 0 5 8 9 10			

Item Number/Label	03: I Can Use Other Word Processing Software.				04: I Can Use Whole Language Approach for Teaching of Writing.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
Not At All With Help of	0	44	9.3	9.3	0	42	8.9	8.9
Another	1	4	.8	10.2	1	6	1.3	10.2
	2	43	9.1	19.3	2	23	4.9	15.0
On-Screen Tutorial Plus	3	14	3.0	22.2	3	8	1.9	16.9
Manual	4	17	3.6	25.8	4	14	3.0	19.9
	5	52	11.0	36.9	5	48	10.2	30.1
With On-Screen Tutorial	6	14	3.0	39.8	6	17	3.6	33.7
Alone	7	44	9.3	49.2	7	45	9.5	43.2
	8	91	19.3	68.4	8	100	21.2	64.4
Easily From Memory	9	91	19.3	87.7	9	122	25.8	90.3
	10	58	19.3	100.0	10	46	9.7	100.0
	Total:	472	100.0			472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 1 4 8 9 10				Value: 1 5 8 9 9			

Table continued

Table 3 Continued

Item Number/Label	05: I Can Use Whole Language Approach For Teaching Reading.				06: I Can Use Computer Technology for Teaching Reading.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
Not At All	0	51	10.8	10.8	0	5	1.1	1.1
With Help of Another	1	4	.8	11.7	1	1	.2	1.3
	2	18	3.8	15.5	2	9	1.9	3.2
On-Screen Tutorial Plus Manual	3	9	1.9	17.4	3	6	1.3	4.4
	4	11	2.3	19.7	4	10	2.1	6.6
	5	41	8.7	28.4	5	17	3.6	10.2
With On-Screen Tutorial Alone	6	14	3.0	31.4	6	8	1.7	11.9
	7	40	8.5	39.8	7	24	5.1	16.9
	8	104	22.0	61.9	8	88	18.6	35.6
Easily From Memory	9	125	26.5	88.3	9	162	34.3	69.9
	10	55	11.7	100.0	10	142	30.1	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90 Value: 0 5 8 9 10				Percentile: 10 25 50 75 90 Value: 5 8 9 10 10			

Item Number/Label	07: I Can Use Computer Technology For Teaching Math.				08: I Can Use Computer Technology For Teaching of Math.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
Not At All With Help of Another	0	6	1.3	1.3	0	197	41.7	41.7
	1	0	0.0	1.3	1	15	3.2	44.9
	2	8	1.7	3.0	2	25	5.3	50.2
On-Screen Tutorial Plus Manual	3	4	.8	3.8	3	13	2.8	53.0
	4	10	2.1	5.9	4	28	5.9	58.9
	5	15	3.2	9.1	5	35	7.4	66.3
With On-Screen Tutorial Alone	6	11	2.3	11.4	6	14	3.0	69.3
	7	23	4.9	16.3	7	28	5.9	75.2
	8	88	18.6	35.0	8	56	11.9	87.1
Easily From Memory	9	157	33.3	68.2	9	36	7.6	94.7
	10	150	31.8	100.0	10	25	5.3	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90 Value: 6 8 9 10 19				Percentile: 10 25 50 75 90 Value: 0 0 2 7 9			

Table Continued

Table 3 Continued

Item Number/Label	09: I Can Use Computer Technology for Social Studies.				10: I Can Use Computer Technology for Teaching Language Arts.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
Not At All With Help of Another	0	209	44.3	44.3	0	28	5.9	5.9.
	1	15	3.2	47.5	1	3	.6	6.6
	2	19	4.0	51.5	2	17	3.6	10.2
On-Screen Tutorial Plus Manual	3	13	2.8	54.2	3	6	1.3	11.4
	4	24	5.1	59.3	4	9	1.9	13.3
	5	34	7.2	66.5	5	25	5.3	18.6
With On-Screen Tutorial Alone	6	9	1.9	68.4	6	9	1.9	20.6
	7	37	7.8	76.3	7	37	7.8	28.4
	8	49	10.4	86.7	8	93	19.7	48.1
Easily From Memory	9	34	7.2	93.9	9	137	29.0	77.1
	10	29	6.1	100.0	10	108	22.9	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 0 0 2 7 9				Value: 2 7 9 9 10			

Item Number/Label	11: I Can Use Computer Technology For Writing.			
Value Label	Value	Frequency	Percent	Cum. Percent
Not At All With Help of Another	0	23	4.9	4.9
	1	5	1.1	5.9
	2	13	2.8	8.7
On-Screen Tutorial Plus Manual	3	3	.6	9.3
	4	11	2.3	11.7
	5	29	6.1	17.8
With On-Screen Tutorial Alone	6	9	1.9	19.7
	7	37	7.8	27.5
	8	99	21.0	48.5
Easily From Memory	9	150	31.8	80.3
	10	93	19.7	100.0
	Total:	472	100.0	
	Percentile: 10 25 50 75 90			
	Value: 4 7 9 9 10			

Table 4

Distributions for Response Values of Part II ÷ 10 (Items 12-15)

Item Number/Label	12: I Know How to Use a Computer Technology to Improve the Writing Process.				13: I Know How A Computer Depends on Binary Numbers to Work.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
Not At All	0	21	4.4	4.4	0	166	35.2	35.2
Well Enough To Help	1	13	2.8	7.2	1	27	5.7	40.9
	2	20	4.2	11.4	2	26	5.5	46.4
With Tutorials &	3	44	9.3	20.8	3	52	11.0	57.4
Materials	4	12	2.5	23.3	4	10	2.1	59.4
	5	16	3.4	36.7	5	27	5.7	65.3
Well Enough to Explain	6	32	6.8	33.5	6	19	4.0	69.3
to Students	7	111	23.5	57.0	7	60	12.7	82.0
	8	70	14.8	71.9	8	33	7.0	89.0
At a Technical	9	76	16.1	87.9	9	31	6.6	95.6
Explanation Level	10	57	12.1	100.0	10	21	4.4	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 2 5 7 9 10				Value: 0 0 3 7 9			

Item Number/Label	14: I Know How Computer Peripherals In My Classroom Work.				15. I Know What A Local Area Network (LAN) Does.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
Not At All With Help of	0	123	26.1	26.1	0	146	30.9	30.9
Another	1	30	6.4	32.4	1	19	4.0	35.0
	2	21	4.4	36.9	2	26	5.5	40.5
On-Screen Tutorial Plus	3	30	6.4	43.2	3	22	4.7	45.1
Manual	4	9	1.9	45.1	4	10	2.1	47.2
	5	30	6.4	51.5	5	20	4.2	51.5
With On-Screen Tutorial	6	20	4.2	55.7	6	20	4.2	55.7
Alone	7	70	14.8	70.6	7	70	14.8	70.6
	8	54	11.4	82.0	8	54	11.4	82.0
Easily From Memory	9	52	11.0	93.0	9	52	11.0	93.0
	10	33	7.0	100.0	10	33	7.0	100.0
	Total:	472	100.0	100.0	Total:	472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 0 0 5 8 9				Value: 0 0 5 8 9			

Table 5

Distributions for Response Values of Part III ÷ 10 (Items 16-27)

Item Number/ Label	16: I Use Software In Conjunction With Basal Texts.				17: I Use Software to Enhance the Students' Skills in Reading			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
I Never Do	0	11	2.3	2.3	0	3	.6	.6
I Rarely Take The	1	7	1.5	3.8	1	4	.8	1.5
Opportunity To Do	2	5	1.1	4.9	2	4	.8	2.3
	3	9	1.9	6.8	3	4	.8	3.2
I Rarely Take The	4	16	3.4	10.2	4	4	.8	4.0
Opportunity To Do	5	10	2.1	12.3	5	12	2.5	6.6
I Usually Take The	6	16	3.4	15.7	6	16	3.4	10.0
Opportunity To Do	7	23	4.9	20.6	7	21	4.4	14.4
	8	49	10.4	30.9	8	47	10.0	24.4
I Routinely Do	9	178	37.7	68.6	9	180	38.1	62.5
	10	148	31.4	100.0	10	177	37.5	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 4 8 9 10 10				Value: 6 9 9 10 10			

Item Number/Label	18: I Use Software to Enhance Students' Skills in Writing.				19. I Use Software to Enhance Students' Skills in Math.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
I Never Do	0	16	3.4	3.4	0	4	.8	.8
I Rarely Take The	1	4	.8	4.2	1	2	.4	1.3
Opportunity To Do	2	6	1.3	5.5	2	3	.6	1.9
	3	10	2.1	7.6	3	4	.8	2.8
I Rarely Take The	4	12	2.5	10.2	4	5	1.1	3.8
Opportunity To Do	5	13	2.8	12.9	5	13	2.8	6.6
I Usually Take The	6	16	3.4	16.3	6	17	3.6	10.2
Opportunity To Do	7	39	8.3	24.6	7	18	3.8	14.0
	8	88	18.6	43.2	8	50	10.6	24.6
I Routinely Do	9	136	28.8	72.0	9	178	37.7	62.3
	10	132	28.0	100.0	10	178	37.7	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 4 8 9 10 10				Value: 6 9 9 10 10			

Table Continued

Table 5 Continued

Item Number/Label	20: I Troubleshoot Minor Problems With Computer Hardware.				21: I Troubleshoot Minor Problems with Computer Software.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
I Never Do	0	77	16.3	16.3	0	70	14.8	14.8
I Rarely Take The	1	71	3.4	19.7	1	15	3.2	18.0
Opportunity To Do	2	13	2.8	22.5	2	16	3.4	21.4
	3	23	4.9	27.3	3	18	3.8	25.2
I Rarely Take The	4	23	4.9	32.2	4	19	4.0	29.2
Opportunity To Do	5	27	5.7	37.9	5	26	5.5	34.7
I Usually Take The	6	21	4.4	42.4	6	23	4.9	39.6
Opportunity To Do	7	43	9.1	51.5	7	40	8.5	48.1
	8	81	17.2	68.6	8	81	17.2	65.3
I Routinely Do	9	87	18.4	87.1	9	98	20.8	86.0
	10	61	12.9	100.0	10	66	14.0	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 0 3 7 9 10				Value: 0 3 8 9 10			

Item Number/Label	22: I Use the Computer to Teach Science Simulations.				23. I Use Graphics Software to Enhance Children's Writing Skills.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
I Never Do	0	295	62.5	62.5	0	64	13.6	13.6
I Rarely Take The	1	24	5.1	67.6	1	11	2.3	15.9
Opportunity To Do	2	20	4.2	71.8	2	13	2.8	18.6
	3	13	2.8	74.6	3	6	1.3	19.9
I Rarely Take The	4	29	6.1	80.7	4	15	3.2	23.1
Opportunity To Do	5	13	2.8	83.5	5	24	5.1	28.2
I Usually Take The	6	14	3.0	86.4	6	22	4.7	32.8
Opportunity To Do	7	24	5.1	91.5	7	41	8.7	41.5
	8	22	4.7	96.2	8	82	17.4	58.9
I Routinely Do	9	11	2.3	98.5	9	109	23.1	82.0
	10	7	1.5	100.0	10	85	18.0	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 0 0 0 4 7				Value: 0 5 8 9 10			

Table Continued

Table 5 Continued

Item Number/Label	24: I Schedule Use of Appropriate Computer Technology Through The Day.				25: I Incorporate Technology Each Day.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
I Never Do	0	22	4.7	4.7	0	25	5.3	5.3
I Rarely Take The	1	4	.8	5.5	1	3	.6	5.9
Opportunity To Do	2	7	1.5	7.0	2	3	.6	6.6
	3	5	1.1	8.1	3	8	1.7	8.3
I Rarely Take The	4	10	2.1	10.2	4	6	1.3	9.5
Opportunity To Do	5	19	4.0	14.2	5	21	4.4	14.0
I Usually Take The	6	12	2.5	16.7	6	18	3.8	17.8
Opportunity To Do	7	29	6.1	22.9	7	24	5.1	22.9
	8	59	12.5	35.4	8	57	12.1	35.0
I Routinely Do	9	145	30.7	66.1	9	149	31.6	66.5
	10	160	33.9	100.0	10	158	33.5	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 4 8 9 10 10				Value: 5 8 9 10 10			

Item Number/Label	26: I Incorporate Technology In Every Subject.				27. I Incorporate a Systematic Approach for Organizing Activities.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
I Never Do	0	110	23.3	23.3	0	33	7.0	7.0
I Rarely Take The	1	15	3.2	26.5	1	5	1.1	8.1
Opportunity To Do	2	18	3.8	30.3	2	5	1.1	9.1
	3	16	3.4	33.7	3	9	1.9	11.0
I Rarely Take The	4	37	7.8	41.5	4	10	2.1	13.1
Opportunity To Do	5	46	9.7	51.3	5	26	5.5	18.6
I Usually Take The	6	21	4.4	55.7	6	20	4.2	22.9
Opportunity To Do	7	68	14.4	70.1	7	42	8.9	31.8
	8	83	17.6	87.7	8	72	15.3	47.0
I Routinely Do	9	40	8.5	96.2	9	141	29.9	76.9
	10	18	3.8	100.0	10	109	23.1	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 0 1 5 8 9				Value: 3 7 9 9 10			

Table 6

Distributions for Response Values of Part IV ÷ 10 (Items 28-33)

Item Number/Label	28: Judgement of Current Match Between Computing and Reading.				29: Judgement of Current Match Between Computing and Math.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
Of No Value	0	6	1.3	1.3	0	8	1.7	1.7
Helpful for Occasional	1	1	.2	1.5	1	2	.4	2.1
Supplementary	2	6	1.3	2.8	2	3	.6	2.8
Instruction	3	7	1.5	4.2	3	6	1.3	4.0
	4	20	4.2	8.5	4	16	3.4	7.4
Highly Desirable in	5	8	1.7	10.2	5	6	1.3	8.7
Daily Planned	6	7	1.5	11.7	6	8	1.7	10.4
Instruction	7	18	3.8	15.5	7	21	4.4	14.8
	8	123	26.1	41.5	8	119	25.2	40.0
Of Critical Value	9	118	25.0	66.5	9	122	25.8	65.9
	10	158	33.5	100.0	10	161	34.1	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90 Value: 5 8 8 10 10				Percentile: 10 25 50 75 90 Value: 6 8 9 10 10			

Item Number/Label	30: Judgement of Current Match Between Computing and Science.				31. Judgement of Current Match Between Computing and Social Studies.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
Of No Value	0	194	41.1	41.1	0	200	42.2	42.4
Helpful for Occasional	1	22	4.7	45.8	1	17	3.6	46.0
Supplementary	2	10	2.1	47.9	2	13	2.8	48.7
Instruction	3	28	5.9	53.8	3	19	4.0	52.8
	4	55	11.7	65.5	4	58	12.3	65.0
Highly Desirable in	5	26	5.5	71.0	5	26	5.5	70.6
Daily Planned	6	19	4.0	75.0	6	19	4.0	74.6
Instruction	7	27	5.7	80.7	7	22	4.7	79.2
	8	52	11.0	91.7	8	60	12.7	91.9
Of Critical Value	9	19	4.0	95.8	9	21	4.4	96.4
	10	20	4.2	100.0	10	17	3.6	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90 Value: 0 0 3 7 8				Percentile: 10 25 50 75 90 Value: 0 0 3 7 8			

Table continued

Table 6 continued

Item Number/Label	32: Judgement of Current Match Between Computing and Language Arts.				33: Judgement of Current Match Between Computing and Writing.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
Of No Value	0	33	7.0	7.0	0	18	3.8	3.8
Helpful for Occasional	1	4	.8	7.8	1	5	1.1	4.9
Supplementary	2	4	.8	8.7	2	6	1.3	6.1
Instruction	3	10	2.1	10.8	3	5	1.1	7.2
	4	20	4.2	15.0	4	26	5.5	12.7
Highly Desirable in	5	12	2.5	17.6	5	12	2.5	15.3
Daily Planned	6	13	2.8	20.3	6	13	2.8	18.0
Instruction	7	26	5.5	25.8	7	22	4.7	22.7
	8	113	23.9	49.8	8	107	22.7	45.3
Of Critical Value	9	117	24.8	74.6	9	118	25.0	70.3
	10	120	25.4	100.0	10	140	29.7	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 3 7 9 10 10				Value: 4 8 9 10 10			

Table 7

Distributions for Response Values of Part V ÷ 10 (Items 34-39)

Item Number/Label	34: Judgement of Potential Match Between Computing and Reading.				35: Judgement of Potential Match Between Computing and Math.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
No Likely Future	0	13	2.8	2.8	0	14	3.0	3.0
Value	1	4	.8	3.6	1	4	.8	3.8
Some Potential for	2	7	1.5	5.1	2	4	.8	4.7
Occasional	3	4	.8	5.9	3	3	.6	5.3
Supplementary Inst.	4	17	3.6	9.5	4	12	2.5	7.8
Reasonable Potential in	5	13	2.8	12.3	5	13	2.8	10.6
Daily Planned	6	5	1.1	13.3	6	6	1.3	11.9
Instruction	7	11	2.3	15.7	7	13	2.8	14.6
	8	125	26.5	42.2	8	129	27.3	41.9
Likely Critical Value	9	97	20.6	62.7	9	98	20.8	62.7
	10	176	37.3	100.0	10	176	37.3	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 5 8 9 10 10				Value: 5 8 9 10 10			

Table Continued

Table 7 continued

Item Number/Label	36: Judgement of Potential Match Between Computing and Science.				37: Judgement of Potential Match Between Computing and Social Studies.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
No Likely Future	0	82	17.4	17.4	0	84	17.8	17.8
Value	1	16	3.4	20.8	1	14	3.0	20.8
Some Potential for	2	15	3.2	23.9	2	14	3.0	23.7
Occasional	3	15	3.2	27.1	3	18	3.8	27.5
Supplementary Inst.	4	53	11.2	38.3	4	50	10.6	38.1
Reasonable Potential in	5	20	4.2	42.6	5	17	3.6	41.7
Daily Planned	6	16	3.4	46.0	6	15	3.2	44.9
Instruction	7	30	6.4	52.3	7	33	7.0	51.9
	8	120	25.4	77.8	8	127	26.9	78.8
Likely Critical Value	9	44	9.3	87.1	9	43	9.1	87.9
	10	61	12.9	100.0	10	57	12.1	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 0 3 7 8 10				Value: 0 3 7 8 10			

Item Number/Label	38: Judgement of Potential Match Between Computing and Language Arts.				39. Judgement of Potential Match Between Computing and Writing.			
Value Label	Value	Frequency	Percent	Cum. Percent	Value	Frequency	Percent	Cum. Percent
No Likely Future	0	24	5.1	5.1	0	21	4.4	4.4
Value	1	3	.6	5.7	1	4	.8	5.3
Some Potential for	2	5	1.1	6.8	2	5	1.1	6.4
Occasional	3	6	1.3	8.1	3	4	.8	7.2
Supplementary Inst.	4	20	4.2	12.3	4	13	2.8	10.0
Reasonable Potential in	5	14	3.0	15.3	5	20	4.2	14.2
Daily Planned	6	8	1.7	16.9	6	10	2.1	16.3
Instruction	7	23	4.9	21.8	7	20	4.2	20.6
	8	122	25.8	47.7	8	118	25.0	45.6
Likely Critical Value	9	95	20.1	67.8	9	97	20.6	66.1
	10	152	32.2	100.0	10	160	33.9	100.0
	Total:	472	100.0		Total:	472	100.0	
	Percentile: 10 25 50 75 90				Percentile: 10 25 50 75 90			
	Value: 4 8 9 10 10				Value: 5 8 9 10 10			

Means and Standard Deviations. Means and standard deviations of Computing Potential items are presented in Table 8. These represent central tendency values (the means) and relative dispersions (standard deviations) around the central tendencies. To interpret, one could isolate

Table 8

Means and Standard Deviations of Computing Potential Items (Val / 10)

Item	Label	Mean	Standard
01	I can use BankStreet Writer.	7.34	2.807
02	I can use Children's Writing/Publishing.	6.49	3.248
03	I can use other word processing software.	6.31	3.168
04	I can use other whole language approach for writing.	6.67	3.014
05	I can use whole language approach for reading.	6.75	3.120
06	I can use computer technology for teaching writing.	8.39	1.993
07	I can use computer technology for teaching math.	8.45	1.953
08	I can use computer technology for teaching science.	3.59	3.674
09	I can use computer technology for teaching social studies.	3.51	3.726
10	I can use computer technology for teaching language arts.	7.60	2.778
11	I can use computer technology for writing.	7.66	2.621
12	How computer improves writing.	6.56	2.803
13	How computer depends on binary nos.	3.60	3.472
14	How computer peripherals work.	4.64	3.644
15	I know what a local area network does.	4.48	3.744
16	Software in conjunction with basal texts.	8.24	2.362
17	Software to enhance reading skills.	8.70	1.809
18	Software to enhance writing skills.	8.00	2.422
19	Software to enhance math skills.	8.72	1.780
20	Troubleshoot minor hardware problems.	5.94	3.518
21	Troubleshoot minor software problems.	6.18	3.480
22	To teach science simulations.	1.87	2.930
23	Graphics to enhance writing skills.	6.65	3.396
24	Schedule computer technology through day.	8.09	2.594
25	I incorporate technology each day.	8.08	2.612
26	I incorporate technology in every subject.	4.84	3.377
27	Systematic approach for organizing activities.	7.54	2.824
28	Current Match between computing and reading.	8.36	2.034
29	Current Match between computing and math.	8.42	2.015
30	Current Match between computing and science.	3.32	3.424
31	Current Match between computing and social studies.	3.32	3.450
32	Current Match between computing and language arts.	7.62	2.817
33	Current Match between computing and writing.	7.94	2.529
34	Potential Match between computing and reading.	8.27	2.334
35	Potential Match between computing and math.	8.34	2.260
36	Potential Match between computing and science.	5.67	3.506
37	Potential Match between computing and social studies.	5.67	3.498
38	Potential Match between computing and language arts.	7.92	2.612
39	Potential Match between computing and writing.	8.04	2.526

the smallest and largest mean. The smallest, 1.87, is associated with Item 22: Level of Present Practice in using the computer to teach science simulations. The largest, 8.72, is associated with Item 19: Level of Present Practice in using software to enhance students' skills in mathematics. Table 8 allows examination of specifics to provide a context for a broader, more usual examination of data of this type. Such a broader examination ordinarily involves combinations of items into a total scale for all 39 items or into scales of items that are related to each other in some way or otherwise logically fit together. Table 9 contains statistical summaries for the scales just described.

Table 9

Item and Scale Statistical Summaries for the Computing Potential Instrument

Scale Name	No. of Variables	Item					Scale	
		Mean	Minimum	Maximum	Max/ Min	Std. Deve.	Mean	Std. Deve.
All Items	39	6.160	1.866	8.718	4.671	1.867	257.8	64.44
Skill	11	6.615	3.515	8.447	2.403		72.76	21.01
Cognitive	4	4.819	3.595	6.559	1.824		19.27	11.33
Practice	12	6.905	1.866	8.718	4.671		82.86	22.77
Current	6	6.498	3.318	8.422	2.538		38.99	12.48
Potential	6	7.318	5.667	8.337	1.471		43.91	14.16
All_Ordr1	11	0.000	0.000	0.000	0.000		.0000	4.770

The column headings of Table 9 may need some explanation. The mean has been addressed earlier, as has the standard deviation (Std Dev). Min represents minimum, and Max

represents maximum, of the item-value means (presented in Table 8) for just those items composing the respective scales.

The last line of Table 9 represents, as items, the first order factors to be presented in the factor analysis section below. The first order factors range across scales having zero means, thus the scale ALL_ORDR1, composed of first order factors, also has a mean of zero.

The smallest mean response for any scale is 4.819 for the COGNITIVE scale, the largest is 7.318 for the POTENTIAL scale. Means on the right side of the scale are not comparable with each other since they are extracted from total scores having different numbers of compositing items. Nevertheless, one may extract some meaning from the column of scale means to the right in Table 9: The average COGNITIVE scale value is 19.27, less than 50 % of a possible 40. The teachers, in absolute terms, indicated a margin for improvement in practice, though not a wide margin: 38.99 CURRENT vs 43.91 POTENTIAL. This matter is examined again under the section labeled MANOVA.

Reliabilities and coefficients of concordance for the theoretical scales of the Computing Potential Instrument are presented with Table 10. The reliability of the ALLITEMS scale is .9437 with a corresponding concordance of .2281. The relatively low concordance value suggests the presence of more than one factor in the ALLITEMS scale. In general, except for the concordance of .6185 for the 4 item COGNITIVE scale, one would expect each scale to be composed of more than one factor.

Table 10

Reliability Analyses (Inter-Item Consistencies) and Coefficients of Concordance of Scales From the Computing Potential Instrument

Scale Name REPORT [COMPUTER]	No. Items	Reliability Coefficients		Kendall's Coefficient Concordance
		Alpha	Standardized Item Alpha	
ALLITEMS	39	.9437	.9503	[.2282]
SKILL	11	.8582	.8714	[.3207]
COGNITIVE	4	.8430	.8384	[.6185]
PRACTICE	12	.8901	.9026	[.3098]
CURRENT	6	.8442	.8641	
POTENTIAL	6	.9112	.9244	
SEC_ORDR	11	.5959	.6035	

Note: Kendall's Coefficients of Concordance were hand calculated.

Factor Analyses. Results of the eight factor analyses are presented in this section. There were two factor analyses for the 39 item scale, one for a six-factor solution (See Table 11 on the following page) and the other for a three-factor solution. Those are followed by factor analyses of the scales for each part: Level of Skill Proficiency, referred to as SKILL; Level of Cognitive Proficiency, referred to as COGNITIVE; Level of Present Practice, referred to as PRACTICE; Current Match (between school subject and computer), referred to as CURRENT; and Potential for Match (between school subject and computer), referred to as POTENTIAL.

The factors extracted from first order analyses of SKILL, PRACTICE, CURRENT, AND POTENTIAL were themselves factor analyzed in the second order analyese that was the last factor analysis produced for this study.

Table 11

Unweighted Least Squares Factor Analysis for Components of the Scale of (39) Item Sums: Six Factor Solution

Kaiser-Meyer-Olkin Measure of Sampling Adequacy = .88767			
Factor Number	Name Conceptual/Computer/for this Table	Factor Number	Name Conceptual/Computer/for this Table
1	/COMPOT1/F_1	7	/ /F_7
2	/COMPOT1/F_2	8	/ /F_8
3	/COMPOT1/F_3	9	/ /F_9
4	/COMPOT1/F_4	10	/ /F_10
5	/COMPOT1/F_5		
6	/COMPOT1/F_6		

			Initial Statistics			
Variable	Initial Commun	Final Commun	Factor Number	Eqigenvalue	Percent of Variance	Cumulative Percent
ITEM001	.44183	.32125	1	13.95438	35.8	35.8
ITEM002	.35678	.30967	2	3.65857	9.4	45.2
ITEM003	.35232	.29936	3	3.42513	8.8	53.9
ITEM004	.76531	.63350	4	1.89913	4.9	58.8
ITEM005	.73930	.54938	5	1.73930	4.5	63.3
ITEM006	.82229	.65610	6	1.31443	3.4	66.6
ITEM007	.81189	.66059	7	1.17349	3.0	69.7
ITEM008	.80516	.63661	8	1.06724	2.7	72.4
ITEM009	.78522	.62474	9	.94360	2.4	74.8

Variable			Initial Statistics			
	Initial Commun	Final Commun	Factor Number	Eigenvalue	Percent of Variance	Cumulative Percent
ITEM010	.59432	.44054	10	.90937	2.3	77.1
ITEM011	.72291	.65126				

Variable			Initial Statistics			
	Initial Commun	Final Commun				
ITEM012	.65659	.62831				
ITEM013	.45736	.40310				
ITEM014	.87524	.89317				
ITEM015	.86808	.86811	Initial Statistics			
ITEM016	.70636	.62176	Factor Number	Eigenvalue	Percent of Variable	Cumulative Percent
ITEM017	.87917	.79013				
ITEM018	.71815	.56028				
ITEM019	.86993	.78591				
ITEM020	.73879	.44199	Final Statistics			
ITEM21	.74772	.45574	Factor	Eigenvalue	Percent of Variance	Cumulative Percent
ITEM022	.53361	.50315	1	13.58644	34.8	34.8
ITEM023	.47402	.41941	2	3.33284	8.5	43.4
ITEM024	.71810	.66646	3	3.08467	7.9	51.3
ITEM025	.66536	.59811	4	1.60802	4.1	55.4
ITEM026	.43905	.42663	5	1.38261	3.5	59.0
ITEM027	.52307	.50314	6	.95612	2.5	61.4
ITEM028	.90195	.71966				
ITEM029	.89230	.70563				
ITEM030	.88632	.76456				
ITEM031	.87677	.73117				
ITEM032	.74206	.62465				

Variable	Initial Statistics	
	Initial Commun	Final Commun
ITEM033	.78901	.62187
ITEM034	.93404	.80345
ITEM035	.93089	.80192
ITEM036	.91795	.60225
ITEM037	.91668	.58032

Variable			Final Statistics			
			Factor	Eigenvalue	Percent of Variance	Cumulative Percent
	Initial Commun	Final Commun				
ITEM037	.91668	.58032				
ITEM038	.87035	.84014				
ITEM039	.87060	.80676				

ULS Extracted Six Factors. Seven Iterations Required.
Factor Matrix

Item	F_1	F_2	F_3	F_4	F_5	F-6
ITEM024	.73	-.12	-.14	-.16	-.21	-.18
ITEM033	.72	-.25	.04	-.08	-.16	-.05
ITEM028	.72	-.38	-.04	-.01	-.15	.19
ITEM019	.72	-.00	-.34	-.19	-.00	.35
ITEM011	.72	.26	-.18	-.08	.13	-.11
ITEM017	.71	.00	-.36	-.23	.01	.31
ITEM032	.71	-.21	.10	-.07	-.24	-.07
ITEM029	.70	-.40	.00	-.01	-.14	.21
ITEM012	.69	.31	-.17	.09	-.02	-.13
ITEM038	.69	-.50	.14	.20	.12	-.17
ITEM016	.68	.02	-.32	-.13	-.02	.19
ITEM018	.68	.14	-.19	-.19	.04	-.03

ULS Extracted Six Factors. Seven Iterations Required. Factor Matrix						
Item	F_1	F_2	F_3	F_4	F_5	F_6
ITEM039	.67	-.50	.14	.18	.12	-.20
ITEM025	.67	-.13	-.12	-.20	-.20	-.20
ITEM006	.67	.16	-.33	.02	.18	.20
ITEM034	.66	-.54	.06	.23	.15	-.02
ITEM007	.65	.18	-.34	.01	.16	.24
ITEM035	.63	-.56	.08	.24	.15	.00
ITEM027	.62	-.07	-.11	-.14	-.17	-.23
ITEM023	.62	.07	-.02	-.13	-.01	-.11
ITEM010	.61	.22	-.08	-.10	.05	.01
ITEM021	.57	.15	-.14	-.04	-.19	-.23
ITEM004	.56	.30	-.04	.06	.46	-.11
ITEM020	.55	.18	-.11	-.03	-.20	-.23
ITEM026	.54	.13	.16	-.19	-.18	-.15
ITEM005	.50	.26	.02	.07	.47	-.12
ITEM001	.49	.20	-.10	.07	.15	.02
ITEM002	.48	.24	-.03	.05	.12	-.05
ITEM003	.43	.23	-.03	.12	.20	-.09
ITEM013	.36	.37	.12	.33	-.09	.03
ITEM030	.41	.11	.69	-.23	-.13	.17
ITEM031	.40	.09	.68	-.21	-.14	.18
ITEM009	.36	.38	.55	-.18	.13	-.01
ITEM008	.35	.42	.54	-.16	.14	-.01
ITEM036	.47	-.30	.48	.10	.19	.11
ITEM037	.46	-.32	.46	.09	.18	.10
ITEM022	.37	.37	.46	-.03	-.10	.00
ITEM015	.46	.38	.04	.63	-.31	.12
ITEM014	.48	.40	.04	.62	-.33	.10

Oblimax Rotation 1, Extraction 1, Analysis 1 — Kaiser Normalization. Oblimin Converged in 10 Iterations.						
Pattern Matrix						
Item	F_1	F_2	F_3	F_4	F_5	F-6
ITEM025	.66	-.14	.01	-.07	-.04	.12
ITEM024	.66	-.15	-.00	-.02	-.05	.17
ITEM027	.62	-.12	-.01	-.03	.02	.06
ITEM021	.59	.05	-.03	.14	.08	.02
ITEM020	.58	.06	.00	.17	.07	-.00
ITEM026	.50	.02	.31	.02	.00	.01
ITEM032	.48	-.33	.15	.08	-.17	.11
ITEM033	.43	-.37	.10	.01	-.11	.18
ITEM023	.40	-.08	.13	-.02	.15	.16
ITEM012	.37	.03	-.02	.29	.28	.16
ITEM035	.02	-.85	-.13	.06	.04	.09
ITEM038	.24	-.84	-.09	.03	.12	-.10
ITEM034	.06	-.84	-.14	.04	.07	.09
ITEM039	-.27	-.82	-.09	.00	.13	-.13
ITEM036	-.17	-.65	.36	.00	.06	.02
ITEM037	-.16	-.65	.34	-.00	.05	.02
ITEM029	.12	-.47	.[illegible]	.06	-.26	.45
ITEM030	.03	-.08	.85	.02	-.16	.07
ITEM031	.02	-.10	.82	.03	-.18	.07
ITEM009	.04	.06	.70	-.01	.27	-.06
ITEM008	.03	.09	.70	.01	.29	-.06
ITEM022	.12	.09	.57	.24	.06	-.08
ITEM014	-.00	-.02	-.02	.97	-.08	.00
ITEM015	-.04	-.04	-.03	.97	-.08	.00
ITEM013	-.01	.02	.12	.56	.11	-.03
ITEM004	.01	-.12	.05	.02	.68	.14

Oblimax Rotation 1, Extraction 1, Analysis 1 — Kaiser Normalization. Oblimin Converged in 10 Iterations.						
Pattern Matrix						
Item	F_1	F_2	F_3	F_4	F_5	F-6
ITEM005	-.02	-.17	.07	-.00	.66	.08
ITEM011	.35	.03	.03	.04	.39	.28
ITEM003	.08	.08	.01	.16	.39	.06
ITEM001	.09	-.06	.00	.14	.32	.20
ITEM002	.14	-.02	.07	.14	.30	.13
ITEM019	.04	.02	.03	-.01	-.04	.88
ITEM017	.08	.04	.02	-.06	-.00	.87
ITEM007	-.07	-.02	-.07	.14	.24	.69
ITEM016	.16	-.00	-.03	.03	.03	.66
ITEM006	-.03	-.02	-.08	.12	.27	.65
ITEM028	.16	-.44	.04	.07	-.25	.46
ITEM018	.36	.04	.07	-.05	.21	.39
ITEM010	.23	.04	.14	.07	.22	.32

Table Continued

Table 11 continued						
Structure Matrix						
Item	F_1	F_2	F_3	F_4	F_5	F-6
ITEM024	.786	-.440	.170	.267	.180	.592
ITEM025	.749	-.405	.167	.209	.159	.534
ITEM027	.696	-.360	.154	.235	.202	.474
ITEM032	.673	-.570	.322	.303	.066	.500
ITEM033	.661	-.602	.272	.260	.108	.550
ITEM021	.651	-.186	.137	.376	.283	.425
ITEM011	.638	-.235	.219	.400	.597	.623
ITEM020	.634	-.166	.166	.393	.284	.394
ITEM012	.634	-.211	.190	.562	.530	.556
ITEM023	.585	-.315	.274	.272	.336	.488
ITEM026	.579	-.229	.418	.279	.209	.343
ITEM038	.499	-.883	.169	.216	.194	.395
ITEM035	.378	-.877	.089	.192	.119	.441
ITEM034	.414	-.871	.090	.200	.152	.463
ITEM039	.500	-.859	.162	.195	.192	.374
ITEM029	.518	-.688	.205	.237	-.022	.638
ITEM036	.167	-.682	.479	.145	.129	.221
ITEM037	.164	-.677	.460	.134	.115	.215
ITEM028	.554	-.676	.180	.258	.000	.667
ITEM030	.251	-.301	.853	.212	.047	.160
ITEM031	.234	-.306	.828	.210	.021	.150
ITEM009	.209	-.101	.744	.239	.394	.102
ITEM008	.197	-.071	.740	.264	.419	.096
ITEM022	.274	-.088	.645	.409	.264	.120
ITEM014	.326	-.144	.196	.941	.251	.291
ITEM015	.292	-.143	.184	.926	.241	.275

Table 11 continued

Structure Matrix

Item	F_1	F_2	F_3	F_4	F_5	F-6
ITEM013	.225	-.077	.269	.614	.316	.187
ITEM004	.345	-.235	.235	.340	.758	.432
ITEM005	.278	-.241	.242	.286	.707	.350
ITEM003	.302	-.170	.162	.350	.487	.309
ITEM001	.363	-.197	.148	.355	.457	.419
ITEM002	.374	-.172	.217	.361	.450	.374
ITEM017	.567	-.311	.100	.248	.280	.886
ITEM019	.549	-.329	.110	.275	.258	.885
ITEM016	.568	-.305	.080	.300	.291	.776
ITEM007	.439	-.231	.062	.403	.480	.761
ITEM006	.459	-.264	.059	.394	.499	.753
ITEM018	.630	-.253	.208	.288	.429	.649
ITEM010	.518	-.209	.268	.354	.431	.548

Factor Score Coefficient Matrix

Item	F_1	F_2	F_3	F_4	F_5	F-6
01	.014	.006	-.004	.018	.064	.022
02	.013	.012	.003	.021	.077	.013
03	.004	-.004	.007	.040	.083	-.008
04	-.033	-.044	.007	-.019	.358	.014
05	-.018	.010	.010	.019	.158	-.000
06	-.027	.027	-.018	.012	.079	.120
07	-.044	-.001	-.029	.047	.120	.148
08	-.014	.035	.215	.006	.104	-.028
09	.001	.008	.170	.010	.114	-.032
10	.015	.008	.011	-.005	.027	.023
11	.078	.013	-.013	.024	.164	.072

Factor Score Coefficient Matrix						
Item	F_1	F_2	F_3	F_4	F_5	F-6
12	.100	.030	-.011	.067	.106	.027
13	-.002	.007	.024	.047	.047	-.018
14	.000	.014	-.009	.517	-.064	-.018
15	-.043	-.004	-.016	.336	-.030	-.002
16	.030	.009	-.012	.006	-.004	.067
17	-.021	.024	-.003	-.045	-.025	.293
18	.069	.005	.010	-.017	.059	.009
19	-.006	.027	.000	-.016	-.067	.256
20	.120	.037	-.016	.035	-.009	-.017
21	.140	.021	-.011	.028	.039	-.025
22	.036	.027	.104	.049	.020	-.016
23	.051	-.000	.017	-.003	.041	.016
24	.212	.011	-.008	-.043	-.065	.013
25	.157	.003	.000	-.033	-.036	.004
26	.092	.009	.045	.008	-.001	-.008
27	.124	.008	-.011	.003	-.012	-.006
28	.030	-.102	-.005	.022	-.134	.126
29	.000	-.090	.029	-.011	-.130	.067
30	.019	-.008	.351	.016	-.113	.020
31	-.027	-.043	.192	-.005	-.063	.008
32	.121	-.008	.033	.008	-.079	.014
33	.078	-.028	.014	.003	-.073	.029
34	-.035	-.166	-.037	.036	.047	.034
35	-.079	-.182	-.065	.039	-.031	.010
36	-.083	-.142	.057	.008	.039	-.016
37	-.066	-.090	.110	-.048	-.015	.024
38	.058	-.256	-.027	-.014	.078	-.083

Factor Score Coefficient Matrix						
Item	F_1	F_2	F_3	F_4	F_5	F-6
39	.084	-.182	-.032	-.047	.048	-.061
Factor Correlation Matrix						
	F_1	F_2	F_3	F_4	F_5	F_6
F_1	1.000					
F_2	-.351	1.000				
F_3	.214	-.217	1.000			
F_4	.358	-.135	.240	1.000		
F_5	.269	-.055	.199	.348	1.000	
F_6	.596	-.373	.100	.320	.324	1.000
Covariance Matrix for Estimated Regression Factor Scores						
F_1	.893					
F_2	-.369	.947				
F_3	.220	-.214	.911			
F_4	.356	-.140	.239	.943		
F_5	.279	-0.061	.194	.338	.852	
F_6	.607	-.374	.104	.323	.329	.936

Study of Table 11 reveals a problem. Examination of the factor structures correlated at absolute values larger than .50 with the variables produces 14 items without simple factor structure. One (Item 12) of the fourteen loads on 4 factors, 5 load on 3 factors, and 10 load on 2 factors. It should be clear that the solution, indeed, violates criteria for simple structure.

Toward the end of this section on factor analyses it is shown that there are 3 second order factors. Furthermore, one may justify extraction and rotation of just 3 factors with the scree criterion. Table 12 presents the unweighted least squares 3 factor solution for the scale composed of 39 Computing Potential Instrument items.

The criterion of simple structure is not fully satisfied with the 3 factor solution. However, just five of the variables have structure coefficients larger than absolute values of .50 on two factors: Items 24, 25, 28, 33, and 32. The structure coefficients for each variable are signed oppositely: all variables loading on the first factor have positive coefficients, all variables loading on the second have negative coefficients. No variable loading higher than absolute value .50 on the third factor loads at absolute value .50 or higher on either of the other factors.

Table 12

Unweighted Least Squares Factor Analysis for Components of the ALL_ITEMS Scale: Three-Factor Solution

Kaiser-Meyer-Olkin Measure of Sampling Adequacy = .88767				
		Initial		
Factor Number	Name Conceptual/Computer/ for this Table	Eigenvalue	Percent of Variance	Cumulative Percent
1	Perform /ORDER11/F_1	13.95438	35.8	35.8
2	Pessimism /ORDER12/F_2	3.65857	9.4	45.2
3	ScSoSt /ORDER13/F_3	3.42513	8.8	53.9
4		1.89913	4.9	58.8

Initial Statistics		Factor Matrix				Final Statistics	
Var	Commun	Var	F_1	F_2	F_3	Var	Commun
01	.44183	33	.72352	-.25246	.04361	01	.29468
02	.35678	24	.72333	-.11402	-.13546	02	.29400
03	.35232	28	.71776	-.37574	-.04211	03	.23806
04	.76531	11	.71650	.27534	-.18273	04	.39027

Initial Statistics		Factor Matrix				Final Statistics	
Var	Commun	Var	F_1	F_2	F_3	Var	Commun
05	.73930	19	.70922	.00216	-.32241	05	.29792
06	.82229	17	.70850	.01276	-.34170	06	.57871
07	.81189	32	.70532	-.21024	.10168	07	.56827
08	.80516	29	.69518	-.39497	.00366	08	.60569
09	.78522	12	.69406	.31186	-.17054	09	.585 /5
10	.59432	38	.68826	-.49994	.13963	10	.43640
11	.72291	18	.68164	.15466	-.18898	11	.62257
12	.65659	16	.68104	.02794	-.31770	12	.60807
13	.45736	39	.66891	-.49159	.13554	13	.26187
14	.87524	25	.66531	-.11593	-.11481	14	.31806
15	.86808	06	.66501	.16440	-.33081	15	.29007
16	.70636	34	.65842	-.53446	.05394	16	.56553
17	.87917	07	.64823	.18724	-.33618	17	.61890
18	.71815	35	.63298	-.55582	.07356	18	.52426
19	.86993	23	.62126	.07470	-.01976	19	.60694
20	.73879	27	.62080	-.06222	-.10530	20	.34454
21	.74772	10	.61355	.23035	-.08304	21	.36197
22	.53361	21	.56482	.14917	-.14387	22	.50470
23	.47402	04	.55382	.28648	-.03840	23	.39193
24	.71810	20	.54854	.17847	-.10857	24	.55456
25	.66536	26	.53985	.13615	.15384	25	.46926
26	.43905	01	.49344	.20258	-.10079	26	.33364
27	.52307	05	.48791	.24390	.01943	27	.40036
28	.90195	02	.48390	.24291	-.02883	28	.65813
29	.89230	14	.46553	.31728	.02601	29	.63928

Initial Statistics		Factor Matrix				Final Statistics	
Var	Commun	Var	F_1	F_2	F_3	Var	Commun
30	.88632	15	.44260	.30559	.02828	30	.63700
31	.87677	03	.42865	.23066	-.03333	31	.60917
32	.74206	13	.35710	.34707	.11787	32	.55202
33	.78901	30	.41121	.11490	.67432	33	.58912
34	.93404	31	.39486	.09182	.66696	34	.72207
35	.93089	09	.35697	.38946	.55375	35	.71500
36	.91795	08	.34862	.43127	.54603	36	.54344
37	.91668	36	.47254	-.30470	.47676	37	.52678
38	.87035	22	.37432	.38204	.46758	38	.74314
39	.87060	37	.46093	-.31588	.46320	39	.70747

Oblimin Rotation 1, Analysis 1 — Kaiser Normalization.
Oblimin Converged in 9 Iterations.

Pattern Matrix				Structure Matrix				Factor Score Coefficient Matrix			
Item	F_1	F_2	F_3	Item	F_1	F_2	F_3	Item	F_1	F_2	F_3
12	.79	.04	.03	11	.79	-.34	.19	01	.041	.012	.009
11	.79	-.00	.01	12	.78	-.29	.21	02	.047	.021	.024
07	.77	-.01	-.18	06	.74	-.34	-.00	03	.037	.013	.028
06	.76	-.04	-.18	07	.73	-.31	-.00	04	.070	.010	.049
17	.70	-.20	-.24	17	.73	-.46	-.06	05	.039	.029	.023
18	.69	-.10	-.04	19	.72	-.48	-.05	06	.081	.026	-.038
19	.68	-.21	-.22	18	.72	-.38	.12	07	.096	.008	-.037
16	.68	-.18	-.21	16	.70	-.44	-.04	08	.025	.039	.224
10	.63	-.02	.08	10	.66	-.30	.22	09	.030	.016	.182
04	.60	.04	.13	24	.65	-.59	.06	10	.038	.002	.007
21	.58	-.06	-.02	04	.61	-.22	.26	11	.118	.022	-.006

Oblimin Rotation 1, Analysis 1 — Kaiser Normalization. Oblimin Converged in 9 Iterations.											
Pattern Matrix				Structure Matrix				Factor Score Coefficient Matrix			
Item	F_1	F_2	F_3	Item	F_1	F_2	F_3	Item	F_1	F_2	F_3
20	.56	-.04	.02	21	.60	-.30	.12	12	.122	.032	.029
01	.54	.00	.04	23	.59	-.41	.21	13	.036	.026	.053
14	.52	.08	.20	25	.59	-.55	.06	14	.054	.028	.062
02	.51	.02	.12	20	.58	-.28	.16	15	.044	.024	.040
24	.51	-.39	-.09	27	.57	-.49	.08	16	.069	-.011	-.043
23	.49	-.20	.08	01	.54	-.22	.16	17	.080	-.026	-.084
15	.49	.08	.19	02	.53	-.20	.23	18	.054	-.011	-.006
05	.49	.00	.16	14	.52	-.15	.30	19	.080	-.017	-.066
03	.47	.04	.10	05	.52	-.21	.27	20	.042	.007	-.000
25	.45	-.37	-.08	15	.50	-.14	.29	21	.061	-.002	.004
27	.45	-.30	-.05	26	.50	-.34	.36	22	.039	.028	.151
13	.41	.13	.28	03	.48	-.17	.20	23	.041	-.012	.014
26	.37	-.16	.26	13	.41	-.06	.36	24	.051	-.052	-.032
35	.03	-.84	-.07	38	.42	-.86	.12	25	.035	-.039	-.017
38	.07	-.83	.02	34	.40	-.84	.02	26	.030	-.016	.036
34	.07	-.82	-.08	35	.36	-.84	.02	27	.035	-.024	-.012
39	.06	-.81	.02	39	.40	-.84	.11	28	.036	-.120	-.046
29	.22	-.69	-.07	29	.49	-.77	.05	29	-.010	-.107	-.026
28	.28	-.67	-.10	28	.53	-.77	.03	30	-.012	-.046	.250
37	-.16	-.65	.37	33	.56	-.71	.15	31	-.010	-.042	.158
36	-.15	-.65	.39	32	.54	-.68	.22	32	.022	-.047	.019
33	.31	-.58	.03	36	.21	-.63	.42	33	.022	-.076	-.004
32	.29	-.55	.10	37	.20	-.62	.40	34	-.014	-.136	-.034
30	-.04	-.29	.73	08	.33	-.08	.76	35	-.022	-.128	-.047
08	.20	.08	.72	30	.25	-.35	.75	36	-.029	-.089	.078

Oblimin Rotation 1, Analysis 1 — Kaiser Normalization.
Oblimin Converged in 9 Iterations.

Pattern Matrix				Structure Matrix				Factor Score Coefficient Matrix			
Item	F_1	F_2	F_3	Item	F_1	F_2	F_3	Item	F_1	F_2	F_3
09	.18	.04	.71	09	.32	-.11	.75	37	-.031	-.083	.084
31	-.06	-.30	.71	31	.23	-.35	.73	38	-.005	-.195	.004
22	.24	.05	.63	22	.36	-.11	.68	39	-.013	-.132	-.005

Factor Correlation Matrix				Cov. Matrix for Estimated Regression Factor Scores			
Factors	F_1	F_2	F_3	Factors	F-1	F_2	F_3
F_1	1.000			F_1	.946		
F_2	-.416	1.000		F_2	-.427	.943	
F_3	.225	-.100	1.000	F_3	.219	-.108	.886

Two variables (Items 03 and 13) in the 3 factor solution of Table 12 do not structure with coefficients having absolute value as large as .50 on at least one factor. However, both do structure significantly on the first factor with coefficients of .48 and .41 respectively.

The three-factor solution compares with the 6 factor solution in that for both factor analyses factors 2 and 3 load similarly. The other factors of the six-factor solution tend to become the first factor of the three-factor solution.

For the three-factor solution, then, the factors may be rather clearly described. Factor 1 reflects all items of Part I: Level of Skill Proficiency; all items of Part II: Level of Cognitive Proficiency; all items of Part III: Level of Present Practice; and three items of Part IV: Current Match between subject and computer with software. The three Current Match items are for reading, language arts, and writing.

Factor 2 is dominated with items from Part V: Potential Match items, involving all items in that part, and contains four of the six items of Part IV: Current Match between subject and computer with software. One notes, furthermore, that the four Current Match Items load higher in absolute value on the second factor than on the first, but load high enough on the first factor to participate in that scale, too. Finally one notes for Factor 2 that the structure coefficient for every item is negative indicating that lower item values are associated with higher factor scores.

Factor 3 is dominated by just five items: 8 and 9 from the level of Skill Proficiency part, 22 from the Level of Present Practice part, and 30 and 31 from the Current Match between subject and computer with software part. One notes that Items 8, 9, 22, 30, and 31 are items reflecting either science or social studies--subjects for which teachers claim little formal preparation in matching with computer and software as a teaching tool.

The three factors are arbitrarily named as follows: Factor 1 is the Performance or Perform factor, Factor 2 is the Pessimism in Match or Pessim factor, and Factor 3 is the Science/Social Studies or ScSoSt factor. Factor 2 suggests teachers tended to provide data with at least moderate correlations between current computer and softwar practice with reading, math, language arts, and social studies, and the potential each has for matching with computers and software packages as teaching tools. This suggestion of the data at this stage of analysis is vindicated in the correlations at the end of Table 12.

The next five tables present a factor analysis for each of the five parts of the instrument in order by part. Factor scores produced from these factor analyses were themselves factor analyzed in a second order factor analysis reported in the last of the factor analysis tables at the end of this section.

Grade Level 2 are significantly the larger, and for Grade Level 4 are significantly the smaller. For SKILL2 —— Low Skill, the unweighted mean for Grade Level 4 is the largest, and for Grade Level 3 is the smallest. (Recall that larger values for Low Skill are less desired as a function of the negative values in all its structure coefficients.) For PRACT3 —— Low Practice and for CURRENT2 —— Negative Current Match, the unweighted means for Grade Level 4 are larger, and for Grade Level 2 are smaller. (Again, smaller factor scores for Low Practice and for Negative Current Match are the more desirable.)

The findings in Table 21 for differences among centroids of the six-factor solution to the 39 item Computing Potential Instrument scores are presented for completeness. The univariate significant differences occur on 2 of the 6 factor score scales: COMPOT3 and COMPOT6. Grade Level 4 scores highest and Grade Level 2 lowest for COMPOT3. The reverse is true for COMPOT6.

Post hoc analyses of the three second-order factor scales in Table 22 produced significant differences for 2 scales. Those differences were on the scales for ORDER21 —— Ability/Applications and ORDER22--Deficiencies. The mean for Grade Level 2 was larger and for Grade Level 4 was smaller on the Ability/Applications scale. The mean for Grade Level 4 was larger and for Grade Level 3 was smaller on the Deficiencies scale. In the case of the Deficiencies scale, higher scores are the least desirable.

MANOVA for the three first-order factors from the factor analysis of the 39 Computing Potential Instrument items is presented in Table 23. The largest mean on the ORDER11 —— Performance factor was for Grade Level 2 and the smallest was for Grade Level 4. The reverse was true for ORDER13 —— Science Social Studies. One should note that the SSS differences

between Grade Levels 2 and 3 were slight, differing from the third significant digit. Therefore, the analyses for the first order factor scores presented in Table 23 may be compared rather directly with the analyses in Table 22. In the comparison, the first factors (ORDER21--Ability/Applications and ORDER11 —— Performance) are similar enough to be considered as comparable factors. Likewise, ORDER22 —— Deficiencies is similar to ORDER12 —— Pessimism, and ORDER23 —— Negative/Traditional is similar to ORDER13 —— Science Social Studies. Although cited as competencies in the JLC communication referenced in the introductory matter of this report, teacher statements volunteered on the instruments and included as Appendix B have a number of references indicating minimal, if any, proficiency with both science and social studies software. Concepts for Negative/ Traditional and Science Social Studies, based on the data analyzed here for the Computing Potential Instrument, have similar origins.

CONCLUSIONS

The order for discussion in this section parallels the order for presentation of findings in the previous section. The presentation is initiated with conclusions drawn from the instrument on the basis of raw data responses to the 39 items of the Computing Potential Instrument. As in the presentation of the findings, the concluding statements reference raw data observed values divided by 10. The second section draws conclusions from the reliability analyses, the third from the factor analyses, and the last from the MANOVAs. For clarity, the present presentation is developed as much as possible on the basis of summarizing figures or tables.

Item Responses

Figure 1 presents the median values of all responses to the Part I: Level of Skill Proficiency Items (1 through 11). Responses to the items had a medium value of 8 or larger except for 2 of the items: numbers 8 and 9 with values of 2. (The reader should recall that a median represents the scaled value of the 50th percentile for the raw data values.) Half of the second, third, and fourth grade teachers report skill levels for teaching science and social studies

In Appropriate Educational Situations, I Can Do				
00	10 20	30 40 50	60 70 80	90 100
Not at all	With help of another person	With on-screen tutorial plus manual	With on-screen tutorial alone	Easily from memory

Level of Cognitive Proficiency		Answer with Scale Number
1.	I can use BankStreet Writer.	1. 8
2.	I can use Children's Writing/Publishing.	2. 8
3.	I can use other word processing software.	3. 8
4.	I can use a whole language (as opposed to a skills) approach for teaching of writing.	4. 8
5.	I can use a whole language (as opposed to a skills) approach for teaching of writing.	5. 8
6.	I can use computer technology for teaching reading.	6. 9
7.	I can use computer technology for teaching math.	7. 9
8.	I can use computer technology for teaching science.	8. 2
9.	I can use computer technology for teaching social studies.	9. 2
10.	I can use computer technology for teaching social studies.	10. 9
11.	I can use computer technology for teaching writing.	12. 9

Figure 1. Computing Potential Part I items with median scores divided by 10 in the answer positions.

with computing technology at levels requiring help of another person or lower. Half of the teachers report skill levels for all other Part I items tending toward skill proficiencies based on memory. One concludes, therefore, that the teachers seem at ease with their skill proficiencies except for using computer technology for teaching science and social studies.

Figure 2 presents medians of responses divided by 10 for the 4 Part II items (12 through 15) representing Levels of Cognitive Proficiency. The lowest median, 3, was for item 13 concerning binary numbers; the highest, 7, was for item 12 concerning the use of computing in improvement of the writing process. Intermediate medians of 5 characterized the working of computer peripherals and local area networks. One concludes that there is considerable room for improvement in self-reported levels of cognitive proficiency for the fundamentals of computing, and especially for the relationship between the binary number system and computing.

In Appropriate Educational Situations, I Can Do			
00	10 20 30 40	50 60 70 80	90 100
Not at all	Well enough to help students with tutorials and manuals	Well enough to explain it to students	At technical explanation level

Level of Skill Proficiency	Answer with Scale Number
12. I know how to use a computer to improve the writing process.	12. 7
13. I know how a computer depends on binary numbers to work.	13. 3
14. I know how computer peripherals in my classroom work.	14. 5

Level of Skill Proficiency	Answer with Scale Number
15. I know what a local area network (LAN) does.	15. 5

Figure 2. Computing Potential Part II items with median scores divided by 10 in the answer positions.

Figure 3 reflects values above which 50% of the teachers report their levels of present practice (items 16 through 27). The reader should note the 0 for item 22 concerning using the computer to teach science simulations. The best interpretation here is that more than half of the teachers never do. Also worthy of note is that half of the teachers claim usually to take the opportunity to incorporate technology in every subject (item 26). Items 20, 21, and 23 suggest respectable involvement with troubleshooting minor hardware and software problems and in the

In Appropriate Educational Situations, I Can Do			
00	10 20 30 40	50 60 70 80	90 100
I never do	I rarely take the opportunity to do	I usually take the opportunity to do	I routinely do

Level of Present Practice	Answer with Scale Number
16. I use software in conjunction with basal tests.	16. 9
17. I use software to enhance the students' skills in reading.	17. 9
18. I use software to enhance the students' skills in writing.	18. 9
19. I use software to enhance the students' skills in math.	19. 9
20. I troubleshoot minor problems with computer hardware.	20. 7

Level of Present Practice		Answer with Scale Number
21.	I troubleshoot minor problems with computer software.	21. 8
22.	I use the computer to teach science simulations.	22. 0
23.	I use graphics software to enhance children's writing skills.	23. 8
24.	I schedule use of appropriate computer technology throughout the instructional day.	24. 9
25.	I incorporate technology each day.	25. 9
26.	I incorporate technology in every subject.	26. 5
27.	I incorporate a systematic approach to organizing class activities.	27. 9

Figure 3. Computing Potential Part III items with median scores divided by 10 in the answer positions.

use of graphics for enhancing children's writing skills. One concludes that the second, third, and fourth grade teachers report routine present practice for using software in conjunction with present practice; for enhancing students' skills in reading, writing, and math; in scheduling use of appropriate computer technology throughout the school day; in incorporating technology every day; and in incorporating a systematic approach to organizing class activities. They do almost as well with troubleshooting minor software problems and in using graphics to enhance students' writing skills. But, one is forced also to conclude that teachers need stimulation to effect a match between computing and science simulations, and to increase their level of practice with incorporating technology in every subject.

Figure 4 presents medians for teacher judgments for current matching between software and computing and the 6 subjects reflected in the Part IV items (28 through 33). One concludes that more than half of the teachers assessed software and computing to be well matched, in fact, to be of current critical value in teaching reading, math, language arts, and writing. One

In Appropriate Educational Situations, I Can Do			
00 10 20 30 40	50 60 70 80	90 100	
Of no value	Helpful for occasional supplementary instruction	Highly desirable in daily, planned instruction	Of critical value

Current Match	Answer with Scale Number
28. Reading.	28. 9
29. Math.	29. 9
30. Science.	30. 3
31. Social studies.	31. 3
32. Language arts.	33. 9
33. Writing	34. 9

Figure 4. Computing Potential Part IV items with median scores divided by 10 in the answer positions.

further concludes half of the teachers rate the current match between both science and social studies at levels of no value or helpful only for occasional supplementary instruction.

The medians of Figure 5 reflect the pattern of those for Figure 4, except the medians of science and math in Figure 5, at 7, are higher than in Figure 4, at 3. In other words, half the teachers report a computer with software to have reasonable potential in daily, planned

instruction, or to be of likely critical value, for both science and social studies. One concludes the teachers believe there is a discrepancy between current and potential matches of computing as a teaching tool for both science and social studies classes.

In Appropriate Educational Situations, I Can Do			
00	10 20 30	50 60 70 80	90 100
No likely future value	Some potential for occasional supplementary instruction	Reasonable potential in daily, planned instruction	Likely critical value

Potential for Match	Answer with Scale Number
34. Reading.	34. 9
35. Math.	35. 9
36. Science.	36. 7
37. Social studies.	37. 7
38. Language arts.	38. 9
39. Writing	39. 9

Figure 5. Computing Potential Part V items with median scores divided by 10 in the answer positions.

Another helpful interpretive mechanism resides in use of the means of all responses to an item rather than the medians. The smallest, 1.87 on a scale of 0 through 10, is associated with Item 22: Level of Present Practice in using the computer to teach science simulations. The largest, 8.72, is associated with Item 19: Level of Present Practice in using software to enhance students' skills in mathematics.

Another view of typical performance arises from examination of the scale values for the whole (the unified scale) and for the various parts of the Cognitive Potential Instrument. The

mean response across all 39 items composing the 39-item scale was 6.610. The smallest mean response for the items composing any scale was 4.819 for the COGNITIVE scale, the largest was 7.318 for the POTENTIAL scale. The average COGNITIVE scale value was 19.27, less than 50% of a possible 40. On the other hand, the teachers, in absolute terms, indicated a margin for improvement in practice, though not a wide margin: 38.99 CURRENT vs 43.91 POTENTIAL.

Reliabilities.

The reliability (alpha) of the 39-item unified scale was .94. Reliabilities (alphas) for the scales for the five parts of the Computing Potential Instrument ranged between .84 for the Level of Cognitive Proficiency Scale to .91 for the Potential for Match Scale.

Factor Analyses

From results of eight separate factor analyses on the various scales of the Computing Potential Instrument (two analyses for the 39-item unified scale, one analysis for each instrument part, and a second order analysis) one concludes that there are three essential factorial constructs supporting the full scale observations:

1. Factor 1 in the unified scale analysis reflects all items of Part I: Level of Skill Proficiency; all items of Part II: Level of Cognitive Proficiency; all items of Part III: Level of Present Practice; and three items of Part IV: Current Match between subject and computer with software. The three matching Current Match items are for reading, language arts, and writing.
2. Factor 2 in the unified analysis is dominated with items from Part V: Potential Match items, involving all items in that part, and contains 4 of the 6 items of Part IV: Current

Match between subject and computer with software. Furthermore, the 4 Current Match Items load higher in absolute value on the second factor than on the first, but load high enough on the first factor to participate in that scale, too. Finally, for Factor 2 the structure coefficient for every item is negative indicating that lower item values are associated with higher factor scores.

3. Factor 3 in the unified analysis is dominated by just five items: 8 and 9 from the level of Skill Proficiency part, 22 from the Level of Present Practice part, and 30 and 31 from the Current Match between subject and computer with software part. Items 8, 9, 22, 30, and 31 are items reflecting either science or social studies--subjects for which teachers claim little formal preparation in matching with computer and software as a teaching tool.

The names arbitrarily chosen for the first order full scale unified factors suggest umbrella concepts over the items structuring on the respective factors. The three factors from analysis of the 39 item unified scale are arbitrarily named as follows: Factor 1 is the Performance or Perform factor, factor 2 is the Pessimism in Match or Pessim factor, and factor 3 is the Science/Social Studies or ScSoSt factor.

The second order analysis of the 11 first order factor scores may be compared rather directly with the analysis of the unified scale for the 39 items. In the comparison, the first factors for each analysis (ORDER21 —— Ability/Applications and ORDER11 —— Performance) are similar enough to be considered as comparable factors. Likewise, ORDER22--Deficiencies is similar to ORDER12 —— Pessimism, and ORDER23 —— Negative/Traditional is similar to ORDER13 —— Science Social Studies. Concepts for Negative/Traditional and Science Social

Studies, based on the data analyzed here for the Computing Potential Instrument, have similar origins.

MANOVAs

For each of the four MANOVAs undertaken on the factor scores, Grade Level is significant at the .001 level in accounting for variance among the data set centroids. The four MANOVAS were for locational centroids for: (a) the 11 factor scales derived from separately factor analyzing each of the five parts of the Computing Potential instrument, (b) the six factor scales derived from factor analyzing the 39 items of the instrument as a unified scale, (c) the three factor scales derived from second order factor analyzing of the 11 first order factor scales, and (d) for the three-factor solution from analyzing the 39 items of the instrument as a unified scale.

Post hoc analyses allowed one to conclude that teachers of second graders scored highest and teachers of fourth graders lowest on the ability/applicati ns and performance scales. The converse conclusion may be drawn for the deficiencies and science social studies scales.

Summary Conclusions. The instrument appears to be valid in that there was real variability in responses both between items and within items. There is no generalization for describing the univariate findings across all items: some items were skewed positively, some were skewed negatively, and some were nicely mound-shaped toward the center of the distribution; some items were somewhat rectangular (platykurtic); and some centered closely around one or two values (leptokurtic). Reliabilities were acceptably large. It is concluded that the instrument as a whole, and in all its parts, measures with useable consistently. It is concluded further that the best factor solution for the instrument is a three-factor solution. Finally, it is concluded that

there were real differences between the perceptions of the second and fourth grade teachers on two of the three factors in the best solution.

SUMMARY AND DISCUSSION

Airasian (1975), reporting on evaluation methods for comparative analysis of attitude measures, concluded that attitude items did not form a unidimensional and cumulative hierarchy. That conclusion generally applies to present findings in that each scale except the Cognitive scale involves at least two factor dimensions. The unified scale of the 39 items factors into a 3 factor solution that compares favorably with the three, second order factors derived from the scale of 11 first order factors arising from separately factor analyzing scales representing each of the five instrument parts.

APS should develop an improvement plan as recommended by Baum (1987) for the Colorado School District. Ideas for reducing the gap between existing and potential practice should be developed in the improvement plan and teachers should be acknowledged in having their responses recognized by providing opportunities for committee or other leadership service.

Bostrom and others (1982) in schools in Great Britian judged the programs to be effective although there was prior underestimation of difficulties in pupil pretraining and class administration Their evaluation indicated a need to maintain interest through relevant program/curriculum developments, appropriate training courses, and complementary research programs. It would appear that an expansion of computing technology as a teaching tool in APS could best be undertaken on two fronts: (a) improvement in areas perceived by teachers as

deficiencies and (b) proacting in the areas of science and social studies to correct for historic oversight in not equipping teachers to operate with related software.

Buttram, J, & others (1986) reporting a cooperative project between the New Jersey School Boards Association (Trenton) and Research for Better Schools, Inc., (Philadelphia, Pa) provided a setting for transferring from information on practice to recommendations for future district improvement. Having analyzed, interpreted, and disseminated the relevant information, recommendations would be needed to motivate planning for district improvement. APS with JLC should develop a plan for overcoming (a) perceived teacher deficiencies, and (b) software proficiencies missed in past teacher instruction.

Coates (1982), writing about computer oriented instruction in Great Britian, explored microcomputer stimulated changes similar to those needed for curriculum practice in APS. There need to be provisions, perhaps in-service provisions, that acquaint teachers with new methodologies for incorporating new computer technologies in instruction and that instruct them in planning strategies. Some of the messages written by responding teachers on their Computing Potential Instruments indicated a serious need for training for professional positions filled after school begins in the fall. When these opportunities are not taken, valuable computer related instruction is difficult, at best.

More information would be helpful concerning three areas of assessment provided for in a checklist developed by Coe (1985): (a) equity in computer access for APS students, (b) district computer planning activities and guidelines, and (c) problems and impediments to successful computer implementation and development in APS classrooms.

Personnel in APS should view the process of evaluating computer use in schools as did Collis (Assessment, 1989), as a formative, on-going process rather than as a summative process. As such, the process should be open to the emergence of unanticipated questions and to the discussion of program shortcomings; a system of regular reporting to program staff should be included; and system goals for the use of computers should be periodically clarified with RAs, local school administrators, and teachers.

Collis (Problems, 1989), reporting on an external evaluation of computer uses in education in the Netherlands suggested the need for special effort in teaching how educational software can be meaningfully used by teachers as a component of their regular teaching activities and in strengthening the teachers' perceptions that using such packages is an effective and efficient response to an educational need. It is clear that APS second, third, and fourth grade teachers could benefit from similar special efforts. Moreover, to support specification of exactly what special efforts would be beneficial, a program should be established for collecting data (monitoring) JLC program implementation in APS with the goal of internal improvement-oriented evaluation as proposed by Herman (1985). Special care should be exercised in developing and presenting to teachers evaluation reports pertaining to the JLC Project.

Further evaluative research should be concerned (as was recommended by Jeger and Slotnik (1985)) with (a) necessary student role changes for JLC interaction, (b) necessary faculty role changes for JLC planning and implementation, (c) surveys of faculty professional development needs for more effective implementation of JLC, (d) points unique to JLC math experiences, (e) points unique to JLC Language Arts experience, (f) students' perceptions of word processing in writing, and (g) unanticipated negative consequences of JLC experiences.

While there are 3 computers in each second, third, and fourth grade classroom, relatively speaking they remain a scarce commodity until every student has opportunity for use as often as use is desired. As long as the computers remain scarce, it is incumbent on APS leadership to insure their coordinated, equitable availability to students. And, equity of access of all second, third, and fourth graders should be addressed, not alone equity for just the fast students, or just the slow or disadvantaged students, but equity for every student in every class supplied with computers. Apparently, there will be barriers to overcome in the process.

Future plans for computer implementation should consider fully the theoretically substantive nature of computer education, the range of sociocultural aspects needing accommodation to implement, and the professional implications of the implementation process itself. Summarizing its annual meeting of 1985, the National School Boards Association (NSBA) raised questions concerning tools of the electronic age and how they might enhance learning opportunities. The NSBA discussion centered, in part, on applications of technology to problems in education and on how the magnitude of technological change may influence the future of education. The current study fits the spirit of NSBA efforts in suggesting avenues for updating the standards for current use of computer technology in Atlanta Public Schools.

Stufflebeam (1981) presented 30 specific standards as guiding principles for evaluations of educational programs, projects, and materials. Two utility standards: (a) Information scope and selection, and (b) report timeliness, of the 30 standards, were under control of the evaluator in constructing the Computing Potential Instrument and reporting results. Both standards seem to have been met. Also under evaluator control and met were two proprietary standards: (a) obligations to provide full and frank disclosure and (b) balanced reporting. Accuracy standards

including object identification, context analysis, described purposes and procedures, defensible information sources, valid measurement, reliable measurement, systematic data control, analysis of quantitative information, analysis of qualitative information, and justified conclusions were fundamental in developing the study. The other standards not mentioned in the foregoing may best be left to the evaluating publics for whom the reports were written for judgments of adequacy.

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APPENDIX A

School: _____ Grade: _____ Section: _____

COMPUTING POTENTIAL IN ATLANTA PUBLIC SCHOOL EDUCATION

Instrument Number: 77130-44715-1 Atlanta Public Schools

I. In the spaces provided, please write the number indicating your level of SKILL PROFICIENCY according to the boxed verbal scale below. Between vertical marks delineating your best category select a number representing how well you function within that category. The number 100, for example, suggests that you easily and proficiently work from memory, while 90 suggests also that you easily work from memory but less proficiently, requiring supporting reference to technical manuals or on-screen tutorials. If you frequently require assistance of the type described to the left of your verbal category, choose a smaller number; if you sometimes operate in the category to the right, choose a larger number.

In Appropriate Educational Situations, I Can Do									
00	10	20	30	40	50	60	70	80	90 100
Not at all	With help of another person		With on-screen tutorial plus manual			With on-screen tutorial alone			Easily from memory

	Level of Cognitive Proficiency	Answer with Scale Number
1.	I can use BankStreet Writer.	1. _____
2.	I can use Children's Writing/Publishing.	2. _____
3.	I can use other word processing software.	3. _____
4.	I can use a whole language (as opposed to a skills) approach for teaching of writing.	4. _____

Level of Cognitive Proficiency		Answer with Scale Number
5.	I can use a whole language (as opposed to a skills) approach for teaching of writing.	5. _____
6.	I can use computer technology for teaching reading.	6. _____
7.	I can use computer technology for teaching math.	7. _____
8.	I can use computer technology for teaching science.	8. _____
9.	I can use computer technology for teaching social studies.	9. _____
10.	I can use computer technology for teaching social studies.	10. _____
11.	I can use computer technology for teaching writing.	12. _____

II. In the spaces provided, please write the number representing your level of COGNITIVE PROFICIENCY according to the boxed verbal scale below. Between vertical marks delineating your best category select a number representing how well you function within that category. As in I above, if you feel you sometimes operate in the category to the left of your typical functioning, choose a smaller number to represent your category; or, if you sometimes operate in the category to the right, choose a larger number for your scaled category value.

In Appropriate Educational Situations, I Can Do			
00	10 20 30 40	50 60 70	80 90 100
Not at all	Well enough to help students with tutorials and mamuals	Well enough to explain it to students	At technical explanation level

Level of Skill Proficiency		Answer with Scale Number
12.	I know how to use a computer to improve the writing process.	12. _____
13.	I know how a computer depends on binary numbers to work.	13. _____
14.	I know how computer peripherals in my classroom work.	14. _____
15.	I know what a local area network (LAN) does.	15. _____

III. In the spaces provided, please indicate your level of PRESENT PRACTICE as a number representing the scaled verbal category from the following boxed values.

In Appropriate Educational Situations, I Can Do			
00	10 20 30 40	50 60 70 80	90 100
I never do	I rarely take the opportunity to do	I usally take the opportunity to do	I routinely do

Level of Present Practice		Answer with Scale Number
16.	I use software in conjunction with basal tests.	16. _____
17.	I use software to enhance the students' skills in reading.	17. _____
18.	I use software to enhance the students' skills in writing.	18. _____
19.	I use software to enhance the students' skills in math.	19. _____
20.	I troubleshoot minor problems with computer hardware.	20. _____
21.	I troubleshoot minor problems with computer software.	21. _____
22.	I use the computer to teach science simulations.	22. _____
23.	I use graphics software to enhance children's writing skills.	23. _____
24.	I schedule use of appropriate computer technology throughout the instructional day.	24. _____
25.	I incorporate technology each day.	25. _____
26.	I incorporate technology in every subject.	26. _____
27.	I incorporate a systematic approach to organizing class activities.	27. _____

IV. In the spaces provided, please indicate your judgement of the general, CURRENT match between each indicated subject and a computer with software as a teaching tool.

In Appropriate Educational Situations, I Can Do			
00	10 20 30 40	50 60 70 80	90 100
Of no value	Helpful for occasional supplementary instruction	Highly desirable in daily, planned instruction	Of critical value

Current Match	Answer with Scale Number
28. Reading.	28. _____
29. Math.	29. _____
30. Science.	30. _____
31. Social studies.	31. _____
32. Language arts.	33. _____
33. Writing	34. _____

V. In the spaces provided, please indicate your judgement of the general POTENTIAL for matching between each indicated subject and a computer and software as a teaching tool.

In Appropriate Educational Situations, I Can Do			
00	10 20 30 40	50 60 70 80	90 100
No likely future value	Some potential for occasional supplementary instruction	Reasonable potential in daily, planned instruction	Likely critical value

Potential for Match	Answer with Scale Number
34. Reading.	34. _____
35. Math.	35. _____
36. Science.	36. _____

Potential for Match	Answer with Scale Number
37. Social studies.	37. _____
38. Language arts	38. _____
39. Writing	39. _____

VI. Please express yourself in the space provided below concerning additional areas you would suggest for future surveys of the potential of computing as an educational tool in contemporary education.

_____

_____

_____

_____

APPENDIX B

Messages and Comments: Computing Potential in Atlanta Public Education

Brandon: Grade 2, Section 4 (One of the first instruments in the stack.)

Helaine Buchwald —— "I entered Brandon as a second grade teacher in February 1990, and was too late to receive any software for my classroom. I have had no experience with computers and feel that I cannot adequately answer these questions."

Virginia P. Ward, a third grade teacher at Kirkwood Elementary School did not answer the Computing Potential Questionnaire, substituting instead her answers to the SPARTA GROUP Instrument.

Carol Daniels, a third grade teacher at Sarah Smith School did not answer the Computing Potential Questionnaire, substituting instead her answers to the SPARTA GROUP Instrument.

Question 1

First 27 items were answered with check marks.

Question 9

Respondent answered with "?" and a comment to Items 2, 8, 9. The comment read: "These are not available even though the 'situation is appropriate.'

References were to the following software: Children's Writing/Publishing, science, social studies.

Question 17

Notes on Items 8, 9, 10: "We do not have software."

Notes on Items 30, 31, 36, 37: "We do not have software."

Question 20

Notes on Items 8, 9: "We do not have software."

Notes on 30, 31, 36, 37: "We do not have software."

Question 40 with Code Number 39

This person has a number of 90's for questions of present practice, and 90's for all questions of current match and potential for match.

Question 44 with Code Number 43

Notes on Items 8, 9: "don't have any"

Notes on 22, 23, 30, 31: "don't have any."

Question 56 with Code Number 55

Beecher School, Grade 2, Section 2: "Don't teach science"

Question 72 with Code Number 71

Oglethorpe Elementary, Second Grade, Section 1:

Note on Item 26: "Not Available."

Question 97 with Code Number 96

Items 8, 9, and 22 were answered with 60's and the accompanying note: "I would like to get some."

Question 109 with Code Number 108

Items 4 and 5 were answered with 00's and the accompanying note: "Don't Know Yet."

Question 116 with Code Number 115

Items 30, 31, 36, and 37 were answered with NA's.

Question 118 with Code Number 117

Items 8, 9, 30, 31, 36, 38, and 38 were answered with NA's.

Question 119 with Code Number 118

Items 2, 8, 9, 30, and 31 were answered with NA's.

Item 26 was answered with "Don't have programs."

Question 120 with Code Number 119

Items 8, 9, 22, 30, and 31 were answered with NA's.

Question 121 with Code Number 120

Items 2, 30, and 31 were answered with NA's.

Items 9 and 10 contained the note: "No programs in school at present."

Question 122 with Code Number 121

Items 30 and 31 were answered with NA's.

Question 124 with Code Number 123

Items 22, 30, 31, 36, and 37 were answered with NA's.

Question 133 with Code Number 132

Item 22 was answered with NA Personal Comment: "I haven't been introduced to any software for science and social studies."

Question 140 with Code Number 139

Items 30 and 31 were answered with NA's.

Question 142 with Code Number 142

Items 2, 22, 26, 30, and 31 were answered with NA's. A further comment on Item 26: "Not social studies or science"

A comment at the end: "It would be nice if we would be provided with software for social studies and science or the funds made available for purchase of personal software for these subject areas."

Question 144 with Code Number 144

Note on items 30 and 31: "It is of critical value, but we have no software.

Question 146 with Code Number 146

Items 4, 5, 9, and 31 were answered with NA's. A further comment on Item 26: "Not social studies or science."

Item 8 had the comment: "Never shown how program works."

Item 9 had the comment: "No software--incorporate writings."

Question 152 With Code Number 152

This person has a number of 100's for all questions of current match, and 90's for all questions of potential for match.

Question 156 With Code Number 156

This person has a number of 70's for Items 32 & 33 of current match, and 50's for Items 38 and 39 of potential for match.

Question 169 With Code Number 169

This person has generally higher values for current match items than for corresponding items under potential match.

Question 170 With Code Number 170

This person has generally higher values for current match items than for corresponding items under potential match.

Question 174 With Code Number 174

Every response was 100 except for two 90's on Items 3 and 8.

Question 186 with Code Number 186

Items 2, 8, 9, and 22 were answered with NA's. A further comment on Item 26: "Software not available" Question 188 with Code Number 188 Items 2, 8, 9, and 22 were answered with NA's. A further comment on Item 26: "Software not available."

Question 190 With Code Number 190

Current match for social studies was rated higher than potential match.

Question 195 With Code Number 195

This person has a number of 100's for Items 30 and 31 of Current Match, and 90's for Items 36 and 37 of Potential for Match.

Question 201 With Code Number 201

This person has a number of 100's for Items 28 and 29 of Current Match, 90's for Item 34 and 35 of Potential for Match.

Question 207 with Code Number 207

Items 3 and 9 were answered with NA's.

Question 209 with Code Number 209

Items 3 and 9 were answered with NA's.

Question 211 With Code Number 211

This person has a number of 90's for Items 28 and 29 of Current Match, and 80's for Items 34 and 35 of Potential for Match.

Question 213 With Code Number 213

This person has a number of 90's for Items 28 & 29 of Current Match, and 80's for Items 34 and 35 of Potential for Match.

Question 214 With Code Number 214

This person has generally higher values for current match items than for corresponding items under potential match.

Question 215 with Code Number 215

Items 8 and 9 were answered with NA's.

Question 218 With Code Number 218

This person has generally higher values for current match items than for corresponding items under potential match.

Question 221 with Code Number 221

Items 8, 9, and 22 were answered with NA's.

Question 223 With Code Number 223

This person has a number of 75 for Item 319 of Current Match, and 40's for Item 37 of Potential for Match.

Question 230 with Code Number 230

All current match items were answered; but only 2 of Potential for Match items were answered.

Question 232 With Code Number 232

This person has a number of 40's for Items 30 and 31 of current match, 30's for Items 36 and 37 of Potential for Match. One-hundred for Item 32 and 90 for Item 38.

Question 233 with Code Number 233

This person has 30 for Item 28, 20 for Item 34, 40 for Item 29, and 30 for Item 35.

Question 235 With Code Number 235

This person has generally higher values for current match items than for corresponding items under potential match.

Question 237 With Code Number 237

This person has 80 for Item 28 and 40 for Item 34.

Question 242 With Code Number 242

This person has generally higher values for current match items than for corresponding items under potential match.

Question 245 with Code Number 245

Items 8, 9, 10, 22, 30, 36, and 37 were answered with NA's.

Question 246 with Code Number 246

Items 22-27, 30-32, and 36-39 were answered with NA's.

Question 253 With Code Number 253

This person has 80 for Item 33 and 70 for Item 39.

Question 260 With Code Number 260

Note on Items 8 and 9: "Have had no opportunity."

Note on Item 22: "No materials."

Items 30-32 were answered with NA's.

Question 265 With Code Number 265

This person has 85 for Items 28 and 80, 80 for Item 34, 85 for Items 29 and 30, and 80 for Item 35.

Question 269 With Code Number 269

This person has 50 for Item 32, Item 38 with 00, 50 for Item 33, and 10 for Item 39.

Question 273 With Code Number 273

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 276 With Code Number 276

This person has 80 for Item 30, 50 for Item 36, and _____

Question 278 with Code Number 278

Items 8 and 9 were answered with NA's.

Question 280 with Code Number 280

Items 8 and 9 were answered with NA's. Items 30 and 31 were answered with NA's.

Question 282 With Code Number 282

This person has 70 for Item 29 and 50 for Item 35.

Question 283 With Code Number 283

Respondent answered each Item with a range of values. The center of each range was recorded as the respondent's answer for all Items.

Question 289 With Code Number 289

This person has 90 for Item 28, 80 for Item 34, 90 for Item 29, and 80 for Item 35.

Question 291 With Code Number 291

This person has 40 for Item 32 and 20 for Item 38.

Question 294 With Code Number 294

This person has 90 for Item 32 and 80 for Item 38.

Question 300 With Code Number 300

This person has 90 for Item 32, 80 for Item 38, 90 for Item 33, and 80 for Item 39.

Question 304 With Code Number 304

This person has 80 for Item 28, 40 for Item 34, 80 for Item 29, and 40 for Item 35, 60 for Item 33, and 40 for Item 39.

Question 313 With Code Number 313

This person has 40 for Item 30, 10 for Item 36, 40 for Item 31, and 10 for Item 37.

Question 314 With Code Number 314

This person has 100 for Item 33 and 80 for Item 39.

Question 315 With Code Number 315

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 319 With Code Number 319

This person has 100 for Item 28, 90 for Item 34, 100 for Item 29, 90 for Item 35, 100 for Item 33, and 90 for Item 39.

Question 320 with Code Number 320

Items 8 and 9 were answered with NA's. 15 and 22 NA _____

Question 321 With Code Number 321

This person has 100 for Item 28, 90 for Item 34, 100 for Item 29, 90 for Item 35, 90 for Item 33, and 85 for Item 39.

Question 329 With Code Number 329

This person has 70 for Item 32 and 60 for Item 38.

Question 333 with Code Number 333

Items 2, 8, and 9 were answered with NA's. Items 22, 30, and 31 were answered with NA's 15 and 22 NA's.

Question 335 With Code Number 335

This person has 80 for Item 29, 60 for Item 35, 80 for Item 32, and 60 for Item 38.

Question 337 With Code Number 337

This person has 90 for Item 33 and 80 for Item 39.

Question 339 With Code Number 339

This person has 50 for Item 30, 40 for Item 36, 50 for Item 31, 40 for Item 37, and 90 for Item 32, and 80 for Item 38.

Question 340 with Code Number 340

Items 8 and 9 were answered with NA's. Items 22, 30, and 31 were answered with NA's.

Question 342 with Code Number 342

Items 30 and 31 were answered with NA's.

Question 343 with Code Number 343

Item 9 was answered with NA.

Question 348 With Code Number 348

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 351 With Code Number 350

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 352 With Code Number 351

Items 30 and 31 were left blank with note: "Limited Materials".

Question 353 With Code Number 352

This person has 20 for Item 33 and 00 for Item 39.

Question 355 With Code Number 354

This person has 40 for Item 28, 30 for Item 34, 40 for Item 31, 30 for Item 37, and 90 for Item 33, and 50 for Item 39.

Question 356 With Code Number 355

Items 30 and 31 were left blank with note: "Limited Materials."

Question 357 With Code Number 356

This person ha 30 for Item 30, 00 for Item 36, 40 for Item 31, and 00 for Item 37.

Question 358 With Code Number 357

Items 30 and 31 were answered with NA's.

Question 360 With Code Number 359

Items 30 and 31 were answered with NA's

Question 363 With Code Number 362

This person has 100 for Item 28, 90 for Item 34, 100 for Item 31, 90 for Item 37, 100 for Item 33, and 90 for Item 39.

Question 364 with Code Number 364

Items 8 and 9 were answered with NA's.

Question 366 with Code Number 366

Items 8, 9, 30 and 31 were answered with NA's.

Question 367 with Code Number 367

Items 2, 9, and 10 were omitted with comment: "don't have.' Items 22, 26, 30, 32, 36, and 37 were answered with NA's, ____???_____

Comment: "If software, time and daily assistance were available I could answer this [?] section."

Question 368 with Code Number 368

Items 9, 30, 31, 36, and 37 were answered with NA's.

Question 370 with Code Number 370

Items 8, 9, 30, 31, 36, and 37 were answered with NA's.

Items 28, 29, 32, and 33 were answered with 100 or 80, Items 34, 35, 38, and 39 were not answered, therefore were assigned 00.

Question 375 with Code Number 375

Item 33 was answered with 90 and Item 39 with 80.

Question 376 with Code Number 376

Item 33 was answered with 80 and Item 39 with 70.

Question 378 With Code Number 378

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 379 with Code Number 379

Items 28, 29, 32, and 33 were answered with 100, 34, 35, 38, and 39 were not answered, therefore were assigned 00.

Question 381 with Code Number 381

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 383 with Code Number 383

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 389 with Code Number 389

Item 3O was answered with 80, Item 36 with 40, Item 31 with 80, Item 37 with 70, Items 32 and 33 were answered with 100, and Items 38 and 39 with 90.

Question 392 with Code Number 392

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 394 with Code Number 394

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 400 with Code Number 400

Items 8, 9, 30, and 31 were answered with 00 and comment: "no software.'

Question 404 with Code Number 404

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 406 with Code Number 406

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 407 with Code Number 407

Items 8 and 9 were unanswered with comment: "no software.'

Items 30 and 36 were answered with 80 and comment: "no software.'

Item 22 was unanswered with comment "NA."

Question 408 with Code Number 408

Items 32 was answered with 80, Item 33 with 90, Item 38 with 40, and Item 39 with 80.

Question 411 with Code Number 411

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 415 with Code Number 415

Items 30 and 31 were answered with 80, Item 32 with 90, Items 36 and 37 with 70, and Item 38 with 80.

Question 417 with Code Number 417

Items 8 and 9 were answered as 00 with comment: "don't have."

Question 425 with Code Number 425

Items 8, 9, 22, 30, 31, 36, and 37 were answered with NA's.

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 427 with Code Number 427

Items 8 and 9 were answered WITH "NA.s"

Question 429 with Code Number 429

Items 8, 9, 22, 30, 31, 36, and 37 were answered with NA's.

Question 431 with Code Number 431

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 432 with Code Number 432

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 433 with Code Number 433

Item 32 was answered with 100 and Item 38 with 80.

Question 434 with Code Number 434

Item 28 was answered with 80 and Item 34 with 20.

Question 434 with Code Number 434

Item 28 was answered with 90, Item 34 with 80, Item 29 with 90, Item 34 with 80, Item 33 with 90, and Item 39 with 80.

Question 443 with Code Number 443

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 445 with Code Number 445

Item 32 was answered with 90 and Item 38 with 80.

Question 448 with Code Number 448

Item 29 was answered with 100, Item 35 with 90, Item 30 with 90, Item 36 with 80, Item 33 with 90, and Item 39 with 80.

Question 450 with Code Number 450

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 451 with Code Number 451

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 452 with Code Number 452

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 453 with Code Number 453

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 454 with Code Number 454

Item 28 was answered with 100, Item 34 with 80, Item 29 100, and Item 35 with 80.

Question 455 with Code Number 455

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 456 with Code Number 456

Item 28 was answered with 100, Item 34 with 80, Item 29 with 100, and Item 35 with 80.

Question 457 with Code Number 457

Item 31 was answered with 90, Item 37 with 80, Item 32 with 90, Item 38 with 50, Item 33 with 80, and Item 39 with 60.

Question 458 with Code Number 458

Items 8, 9, 22, [illegible], 31, 36, and 37 were answered with NA's.

Question 459 with Code Number 459

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 460 with Code Number 460

This person has generally higher values for current match Items than for corresponding Items under potential match.

This answer sheet is identical to No. 459.

Question 461 with Code Number 461

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 463 with Code Number 463

Items 7, 8, 9, 19, 22, 29, 30, 31, 35, 36, and 37 were answered with NA's.

Question 464 with Code Number 464

Items 32 was answered with 100, Item 38 with 90, Item 33 with 100, and Item 39 with 90.

Question 465 with Code Number 465

Item 32 was answered with 100, Item 38 with 90, Item 33 with 100, and Item 39 with 90.

Question 466 with Code Number 466

The comment "Limited Software" accompanied each of the following Items: 8, 9, 22, 31. Also: "I only have software for occasional usage. [in] science/social studies[.] I would like more software for science and social studies.

Question 467 with Code Number 467

Item 33 was answered with 100 and Item 39 with 90.

Question 468 with Code Number 468

Items 30 and 31 were answered with NA's.

This person has generally higher values for current match Items than for corresponding Items under potential match.

Question 469 with Code Number 469

This person has generally higher values for current match items than for corresponding Items under potential match.

Question 471 with Code Number 471

Items 8, 9, 22, 26, were answered with NA's.

"If appropriate software is provide [sic] in science and social studies it is very valuable."